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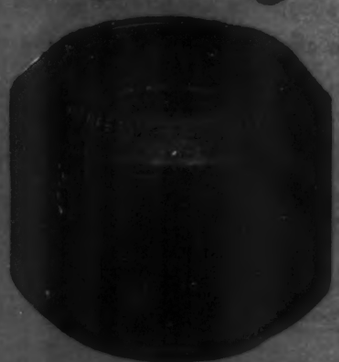

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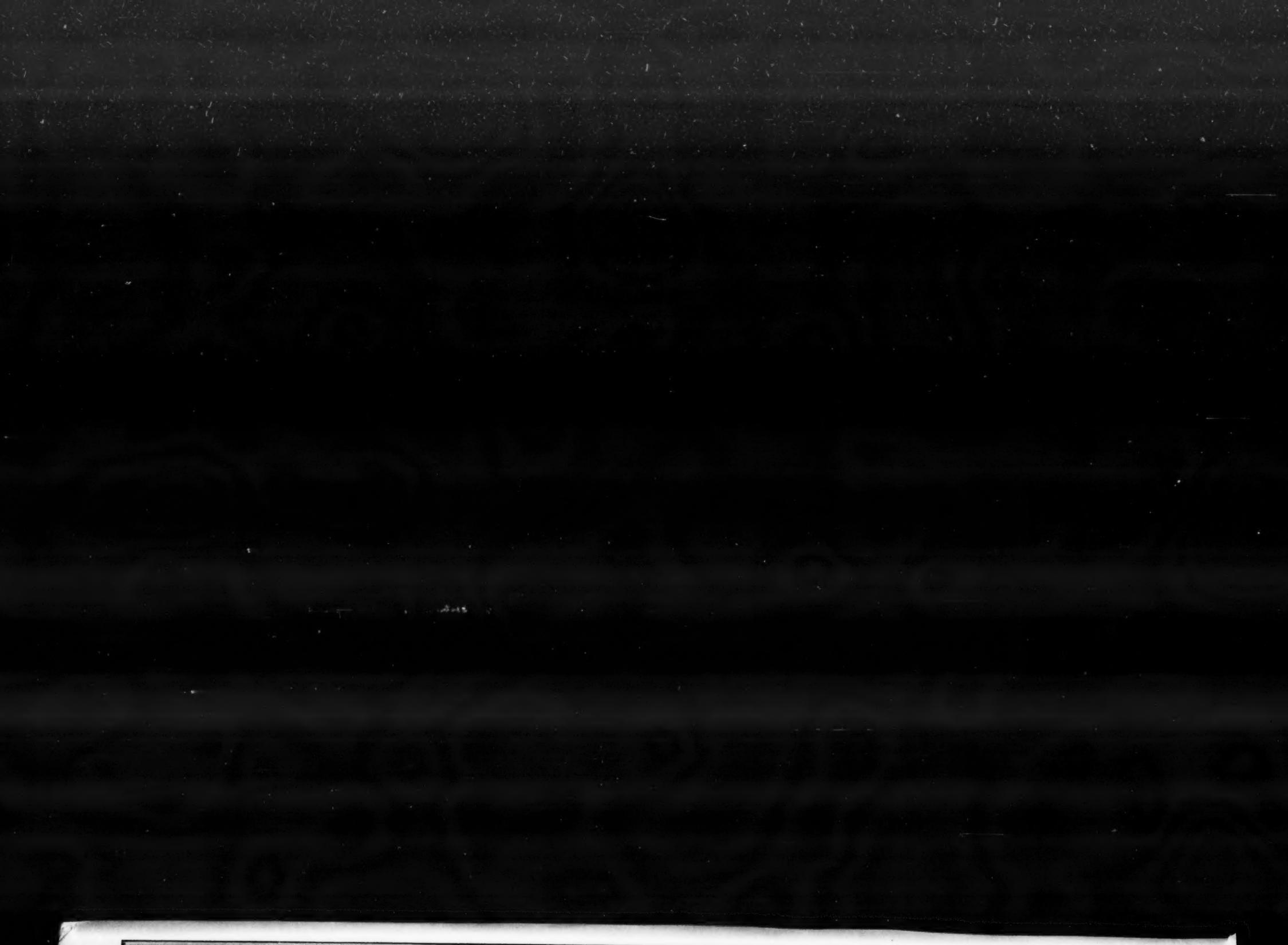

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By V. deP. Gerbereux, Worthington Pump & Machinery Corp.

Most Wells Being Operated at a Loss

Highest production in 1930, week ending Feb. 22, average daily output 2,699,000 bbls. Peak of U. S. production, week ending Aug. 24, 1929 average 2,975,435 bbls.

Prices, Since Latest Reduction, Are Below Lifting Costs. Costly Experience May Hasten General Improvement

By Andrew M. Rowley

Lowest daily average crude oil production in the United States during 1930 was for week ending Dec. 27 with average output of 2,144,074 bbls.

More than half of all the producing wells in the Mid-Continent area are being operated at a loss since the announcement on Monday of this week of further crude oil price reductions which brought the level down to the lowest point in years. In fact, except in pools of large flush production, it is doubtful if any operator in the Mid-Continent territory can show he is making a profit or even breaking even on present prices for crude oil.

Just how long individuals and companies will continue to operate their wells under these conditions is problematical. Orders already have been issued in a number of instances to shut down operations and abandon the wells, at least temporarily.

If any satisfaction is to be gleaned from the most recent price reduction it is in the belief prices cannot go any lower without a general suspension of operations throughout the territory affected. Such a condition might even obtain if the present price level is maintained for any considerable period of time. There is a limit to the losses individuals and companies can assume in their efforts to keep ther organizations intact and their properties operating.

Short-sighted royalty owners, individuals and operators in East Texas are largely responsible for the present situation. More cash than they are accustomed to having is the reason for the orgy of drilling and unlimited production regardless of prices. They cannot or will not see they would receive far more money if their properties were developed conservatively over a long period of time with a return for the oil which would pay expenses and a reasonable profit. When the flush is off those pools and pumping units have to be installed with higher production costs and much less output, they probably will realize their error, but then it will be too late.

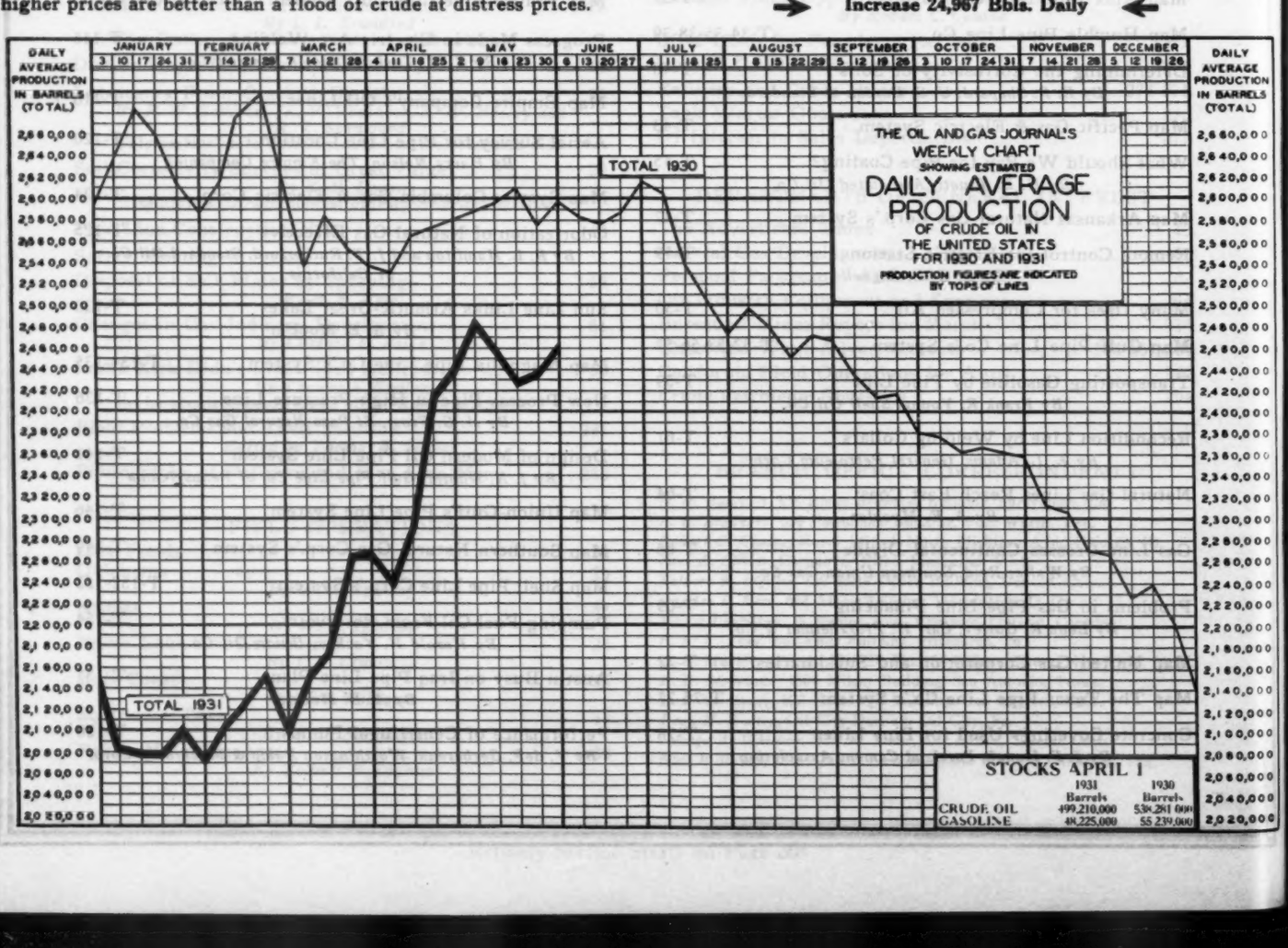
There is a ray of sunshine in the darkness. Crude price reductions were expected and have materialized. It is a costly experience but undoubtedly will hasten a general improvement through engendering a realization upon the part of all that less production and higher prices are better than a flood of crude at distress prices.

PRODUCTION IN THE UNITED STATES

Estimated daily average production of crude oil in the United States for week ended May 30 and a comparison with the previous week follows:

	May 30	May 23
Oklahoma—		
Oklahoma City	132,985	143,360
Seminole-St. Louis	155,860	160,490
Remainder of State	238,590	238,100
Total Oklahoma	527,435	541,950
East Texas—		
Kilgore	156,100	124,250
Lathrop	71,000	61,512
Joiner	123,800	118,000
Total East Texas	350,900	303,762
West Texas	212,181	207,850
North Central Texas	80,703	80,937
Texas Panhandle	61,749	59,002
East Central Texas	55,600	56,742
North Louisiana	38,655	38,890
Arkansas	46,245	46,660
Kansas	106,710	106,270
Total Mid-Continent area	1,480,178	1,442,063
Gulf Coast	173,350	181,760
Southwest Texas	60,500	69,202
Eastern	111,000	110,500
Rocky Mountain area	100,419	98,205
California—		
Santa Fe Springs	72,250	72,250
Long Beach	86,000	86,500
Playa Del Rey	28,500	29,000
Elwood	34,000	34,250
Kettleman Hills	45,500	44,000
Remainder of State	271,500	271,500
Total California	538,750	537,500
Total United States	2,464,197	2,439,230

→ Increase 24,967 Bbls. Daily ←



Suppose We Lift the Lid On Proration?

Larger Companies Could Easily Supply All Country's Requirements for Crude Oil and Gasoline From Their Own Resources

By Andrew M. Rowley

"Proration" and "potential production" are terms synonymous with "petroleum" at the present time. Few questions have caused so much discussion throughout the industry and seldom has the oil business been faced with such a controversial subject as that engendered by proration of crude oil production.

Estimates on potential production vary greatly but all mean very little in the final analysis because the fact remains no more crude oil will ever be produced than can be run by the pipe lines or placed in storage. There is a limit in all fields to the quantity of crude which can be stored and which can be handled by the pipe lines. Regardless of any figured potential, production will not be above the limit of the facilities for handling it for no operator will produce his wells wide open if he cannot save the production in some way.

There have been many arguments for and aginst proration. Whether it was a good thing for the industry to start; whether it should have been continued; and whether, after having followed that plan for so long, the industry should continue that policy—all these questions have their adherents and opponents. It is not the purpose of this article to deal with these arguments. Rather it is the desire to view the situation as it actually exists at this time and point out what may happen in the future.

Large Concerns Own Production

The great bulk of crude oil production—both actual and potential—in the United States at this time is owned by the larger companies. There are just as many independents in this group of large companies as there are so-called Standard companies. These concerns also own a large part of the crude oil and gasoline now held in storage in the United States. According to government figures there was a total of 499,210,000 bbls. of crude oil and 48,225,000 bbls. of gasoline held in storage in this country on April 1.

These larger companies, in addition to owning this production and this crude oil and gasoline in storage, have their own pipe line facilities; their own refineries and, to a large extent, their own filling stations. In other words they are integrated companies. They produce the raw material from their own wells, transport this material to manufacturing plants through their own transportation systems; manufacture this raw material into finished products; and dispose of these finished products through their own sales organizations and outlets.

Less than 20 per cent of the crude oil producers in the United States produce more than 80 per cent of all the crude oil brought to the surface.

Situation Summarized

Summarizing this condition—a comparatively few of the oil companies in the United States easily could produce all the crude oil needed by this country and for our export trade; refine all the crude oil necessary for gasoline and other products requirements; and distribute these products throughout the nation through their own filling stations.

If these larger oil companies were as cold-blooded as many writers would have them appear, the above is exactly the condition which would prevail. Proration has not helped the larger companies. It has been a plan to endeavor to stabilize conditions so that the smaller company and individual producer might remain in business. A majority of the larger companies have supported proration solely because they feel the petroleum industry needs the little producer and sometime will need the production from the small wells.

Agitation against proration has been fostered, in many instances, by the producer who is new in the oil business or by the royalty owner whose sole interest in the petroleum industry is his share of proceeds of crude oil produced by someone else.

Little thought seems to have been given by these opponents of proration to what conditions would prevail should proration be abandoned throughout the country. They are so self-centered in their own immediate neighborhoods and local pools, they cannot vision the picture of the entire industry as a whole.

Tired of Recurring Agitation

Personally, I feel many of the larger companies are becoming tired of this constantly recurring battle to maintain proration and are almost ready to retire from the conflict and conduct their own business as conditions might warrant.

If such decision should be made by the larger oil companies there would be practically no market for crude oil production in the entire United States. Why, under conditions of permitted unlimited production, should companies owning more than 80 per cent of the crude oil production of the country buy crude oil when they could produce more than all their requirements from their own properties?

These companies have sufficient production—actual, potential and undeveloped—to supply all their needs and, in addition, have large reserves of both crude oil and gasoline in storage.

Development work in the fields probably would be increased through lifting proration as the companies, having a market for their own production through their own refineries and filling stations, could inaugurate drilling schedules to maintain their crude oil production to their requirements.

These larger companies have ample finances to carry on all their own operations. They are abundantly able to engage in any such program as they might deem best for their interests.

In such a picture there would be little or no place for the small operator without pipe line facilities or a market for his crude oil. Smaller refineries scattered throughout the country would constitute a market for a fraction of the crude oil production of these operators but producing oil under such conditions would be even less profitable than now and few, if any producers, are making money at this time.

If the Lid Were Lifted

For a short time, immediately following abandonment of proration, the smaller operators undoubtedly could dispose of all their crude oil production but at a price which would mean bankruptcy for them very quickly. Conditions such as prevailed in the East Texas area recently would obtain. Crude oil was sold in East Texas, according to reports, for as low as 8½ cents a barrel. It is entirely reasonable to assume unrestricted production of crude oil would result immediately in a demoralized market situation for the smaller producers with prices ranging anywhere from 5 to 15 cents a barrel in flush fields having a large number of smaller producers such as are located in the East Texas area at this time.

During this comparatively brief period of time, the larger companies with storage and pipe line facilities would take as much of this cheap oil as they could, shutting in their own production elsewhere as, under such conditions, it would be cheaper to buy crude oil than to produce it from one's own properties.

It does not require much of a mathematician to determine how long these producers in flush fields could produce their wells wide open at a loss. In the first place, the field would be depleted of its oil in a comparatively short time. As soon as the flush was off, the producers could not operate their wells as cost of production would be greater than returns from the oil brought to the surface. The older companies with producing properties located in older fields, could then go back to these older leases and operate them as needed to fulfill their crude oil requirements.

Conditions Have Changed

It must be kept in mind conditions within the petroleum industry have changed greatly within the past few years. Development of scientific methods of locating structures favorable to the accumulation of oil and of production practices which insure a maximum recovery from the sand, have opened vast reserves of petroleum heretofore unknown. The larger companies are not as dependent upon the wildcatter as formerly. A number of fields already have been discovered which are capable of producing large quantities of crude oil for years to come, if operated under conservative methods. These fields are controlled largely by the major companies and the output of crude oil would be held to the requirements of the owners. The Salt Creek Field in Wyoming, and the Van Pool in Texas, are good examples of such conservative operation.

With ample reserves already located, orderly development of such proven territory would supply all the crude oil required and would permit a reduction in the burdensome stocks of crude oil now in storage.

It seems entirely logical to assume that lifting proration at this time would result much as follows:

1. An immediate and substantial increase in crude oil production chiefly from the properties of smaller producers or those new in the oil business.

2. Demoralization of the crude oil price structure with operators selling their production for what they can get for it, probably from 5 to 15 cents a barrel.

3. The purchase of this distress oil by the larger companies who would be able to buy this crude at prices below the cost of producing their own properties.

4. Depletion of the flush fields, during which time older proven areas would be curtailed.

5. Passing out of the picture of those operators of flush areas without pipe line facilities, refineries or filling stations as soon as the flush was off the fields and the cost of bringing the crude to the surface exceeded the price received for it.

6. Retirement of the larger companies as crude oil buyers as soon as the distress crude had been purchased.

7. Beginning of an orderly development of older proven areas by the larger companies.

PRODUCTION PROBLEMS CONSIDERED AT MID-YEAR MEETING OF A.P.I.

By L. G. E. Bignell
Petroleum Engineering Editor

DALLAS, Tex., June 2.—Twenty-nine committee meetings, 19 technical papers and addresses, three general sessions, one open session, at least four luncheon meetings and dozens of informal conferences make up the program of the first mid-year meeting of the American Petroleum Institute's Division of Production in the Baker Hotel here this week. Officially the meeting opens tomorrow but a number of committees have been holding sessions since yesterday.

The Institute's board of directors are in attendance following their return tonight from an inspection trip and comparative study of the East Texas and Van oil fields. On Friday they will go to Fort Worth for a scheduled meeting in the Texas Hotel.

Meeting Under New Plan

This is the first gathering of this kind to be held by the division of production of the American Petroleum Institute. In a way it supplements the sessions of the division during the annual meetings of the institute. A forum in which the drilling and producing problems of the petroleum industry can be investigated and discussed and meetings of the various standardization committees of the institute will be held.

The meeting, which will last for two days, June 3 and 4, is attracting hundreds of practical, working oil men for discussion of pertinent field problems, and is held to correlate and review the results of months of work in field and office and to permit consideration of technical details by the many committees, for which time is lacking at the annual meeting of the institute.

The committee meetings are being held in the Baker Hotel here and several special subcommittees on derricks, welded tanks, electric motor frame standardization, gauges and gauging practice, have already met and discussed their problems. The manner in which the details of these various problems were handled indicates the grasp of the subjects had by the members of the committee and the progress made at the meetings insures an early adoption of the various changes proposed.

Tuesday, Wednesday and Thursday will be given over to other committee meetings where equally rapid progress is anticipated in handling other problems. A full program of these various meetings was published in The Oil and Gas Journal May 28, and this schedule is being followed quite closely with a good attendance at each committee meeting.

Visit East Texas Fields

Directors of the Institute and other oil men made a trip through the East Texas and Van Fields today. There were about 75 persons in this tour. The committee in charge of arrangements for this trip chose a route that went from Longview west and north to the Moncrief-Farrell discovery well of the Longview Field, then still further west to the Gladewater area. From Gladewater the route was to the southwest across the Sabine River and then to the southeast to the Kilgore Field.

Lunch was served at the Humble camp in this field and afterward the party moved east through the heart of the Kilgore Field and then almost due south to Henderson. At Henderson the route turned to the west and passed through the Joinerville Field and on through Arp and Tyler and into the Van Pool in Van Zandt County. Supper was served at the Pure Oil Co.'s camp in the Van Pool and from there the party returned to Dallas by bus.

Governor Unable to Attend

Announcement was made today that Governor R. S. Sterling, of Texas, has been unavoidably detained by important engagements at Austin and will be unable to deliver his scheduled address at

(Continued on Page 285)

Await Results of Crude Price Cuts

Expect Refinery Market in Oklahoma to Reflect Lower Raw Material Costs. East Texas Holds Key Position

By C. O. Willson

What effect will the latest drastic cut in crude oil prices have on refined markets in Oklahoma (Group 3) was the question uppermost in the minds of both sellers and buyers the first of the week following the announcement of new posted schedules. The reductions announced Monday averaged approximately 30 cents per barrel amounting to a 50 per cent cut when compared with the price schedules which were made effective in March.

Some observers professed to believe that the refinery market had already discounted the crude oil cut. A prediction that prices will not go much lower appears reasonably safe when present quotations are considered unless some refiners should decide to bring their altruistic programs of the past few months to a close with a grand and probably final gesture and start giving away their plant products. It is doubtful if any refiner will do this knowing that some competitor would no doubt attempt to take his charity business away by giving premiums with each tank car sale.

While the ridiculous features of the present crude oil and refinery market do not obscure the serious phases, of significance to the oil industry generally, they do reflect a mental attitude on the part of many operators who appear to be waiting for the absolute bottom before they will be willing to consider the possibility of improvement. With this state of mind dominating the refinery market, it is entirely possible that the end of the week will see additional price reductions in several products.

Naturals Active

With the possible exception of natural gasoline, blending naphthas and zero, low flash grades of gas oils, it is still a buyers' market and sellers may decide to make additional price concessions although based on open market quotations, many plants are being operated at a loss despite the substantial reductions in crude oil schedules. Natural gasolines appeared stronger the last week in May than during any period in several months. Steady buying since late in April, was aided with an export purchase of over 2,000,000 gallons of stabilized material by one of the export companies. This purchase improved the relative supply and demand situation and the outlook for a continuance of this condition over June is favorable.

Grade AA advanced to 1¾ cents the latter part of last week. Following the crude price reduction on Monday, some manufacturers feared that the refinery gasoline prices would decline and were quoting the AA grade 1⅞ cents. Unless there is a substantial reduction in the refinery gasoline prices, it is believed that a low of 1¾ cents for Grade AA can be maintained over the greater part of June. Three or four large manufacturers who were sellers of natural gasoline during May and April are definitely out of the market for June. Two of these manufacturers have been buyers. On the buying side, June purchases should at least equal those of May. The demand for the stabilized material has been particularly strong. The manufacture of these grades reduces plant yields. To secure stabilized material, it is necessary to take losses of from 20 to 30 per cent based on a Grade AA product. Thus the export order previously mentioned would have amounted to approximately 2,600,000 gallons if Grade AA had been shipped.

Naphtha Buying

The active demand for blending naphthas is closely tied in with the buyer situation which is improving the statistical situation of natural gasoline. A good grade of naphtha of from 48 to 52 gravity with an endpoint not exceeding 450 will bring at least one-eighth cent over the U. S. Motor grade. With these grades up to 50 per cent natural gasoline can be blended. Many jobbers are buying the naphthas and natural gasolines and blending them at their bulk stations giving them a finished motor fuel which is slightly under the prevailing market for the regular grades of refinery gasoline. In at least a couple of cases, major distributors have been pursuing the same policy, the blended motor fuel being colored and sold as a third-grade through their own stations and dealer outlets. If natural gasoline prices should be advanced to within one-fourth or one-half cent of the U. S. Motor price, this blend-

(Continued on Page 286)

REFINED MARKET BAROMETER

A general crude oil reduction in Mid-Continent fields with the expectation that it would spread to other areas further accentuated a weak refinery market during the week. With this crude oil cut and a generally unsettled tank wagon and service station market, refinery tank car prices in several refining groups continued to decline. The export gasoline market also continued weak. In contrast to this refinery gasoline situation, natural gasolines both in the Mid-Continent and California improved. Kerosene prices were reduced both for export and domestic movement. The greatest weakness in all grades of fuels centers in the interior market. The Coastal markets are more active but sellers in those areas have also had trouble in maintaining prices. Paraffin neutrals and bright stocks continued weak with important price reductions. Wax inactive.

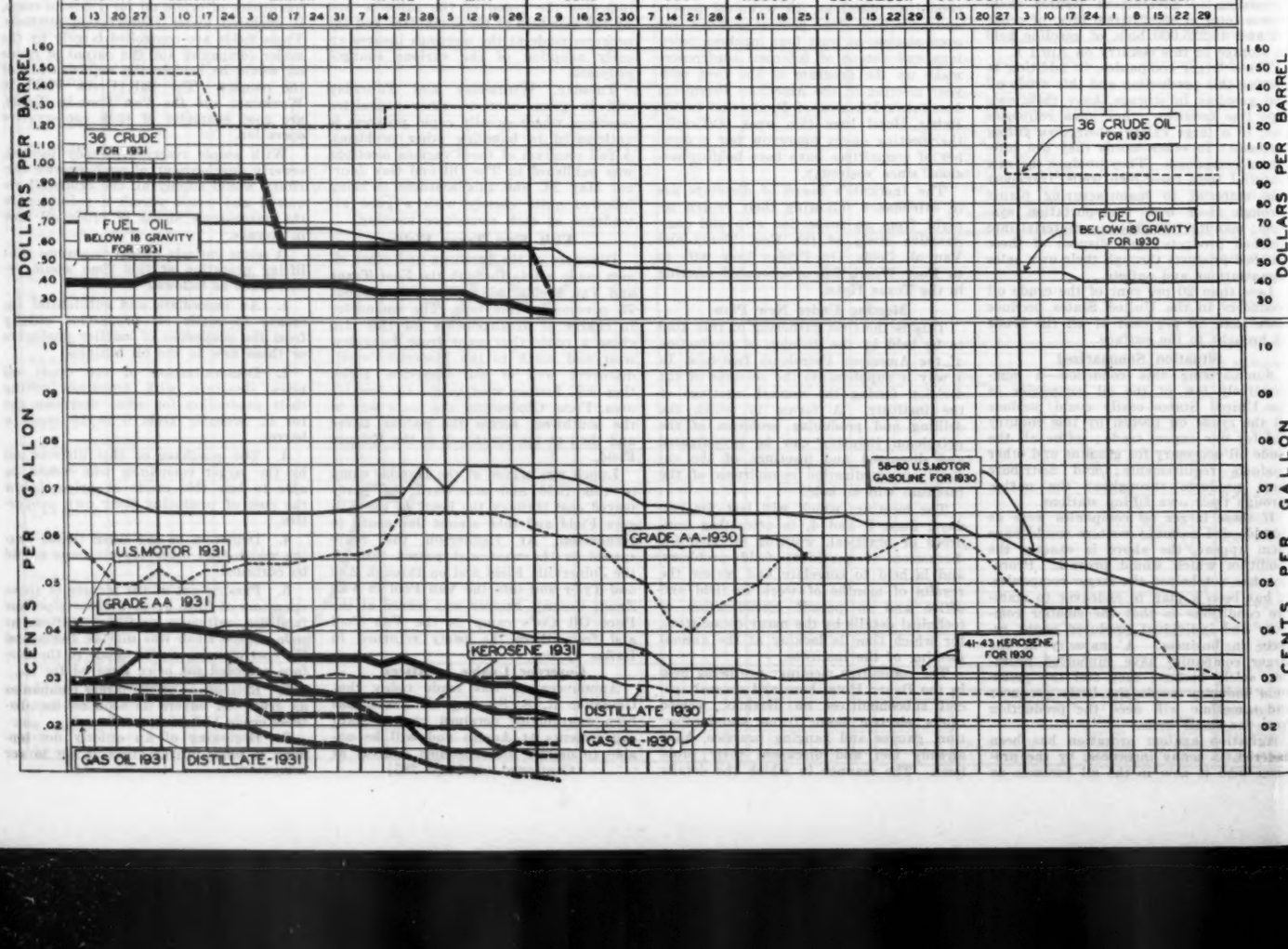
Mid-Continent—Refinery gasoline prices soften following crude price reductions. Fuel oils, gas oils and distillates weaker. Natural gasolines firm. Bright stock and some grades of neutral oils lower. Wax unchanged.

East Coast—Downward price trend in refinery gasolines checked. Kerosene dull. Scattered price reductions in bright stocks and neutral oil prices with better demand. Well sustained marine demand for bunker fuel oil. Gas oil slow. More export inquiries for wax with no changes in prices.

Chicago—Refinery gasoline prices lower. Natural gasolines active and prices firm. Slow demand for fuels and gas oils at lower prices. Kerosene sluggish.

Pennsylvania—Gasoline prices fairly firm. Kerosene prices lower. Reductions in some grades of neutral oils and bright stocks.

Gulf Coast—Gasoline weaker. Improved export movement for gasoline. Other products slow with no important changes in prices.



Crude Prices Below Lifting Charges

Stanolind Company Applies East Texas Prices to Other Mid-Continent Fields. Many Wells May Be Shut In

By James McIntyre

The Stanolind Crude Oil Purchasing Co., subsidiary of the Standard Oil Co. of Indiana, lowered the price it has been paying for Kansas, Oklahoma and Texas crude to an average of 35 cents per barrel on Monday, June 1. The company posted the same schedule of prices that the Humble Oil & Refining Co. applied to the East Texas fields on May 26. The Stanolind's old prices and its new prices follow:

	Old Okla.-Kans. prices	New Okla.-Kans. prices	Difference
Below 29 degrees	.43	.25	.18
29 to 29.9	.45	.26	.19
30 to 30.9	.47	.27	.20
31 to 31.9	.49	.28	.21
32 to 32.9	.51	.29	.22
33 to 33.9	.53	.30	.23
34 to 34.9	.55	.31	.24
35 to 35.9	.57	.32	.25
36 to 36.9	.59	.33	.26
37 to 37.9	.61	.34	.27
38 to 38.9	.63	.35	.28
39 to 39.9	.65	.36	.29
40 and over	.67	.37	.30

The weighted average gravity of the oil produced in the combined fields of Kansas, Oklahoma, North Texas, East Central Texas and Central Texas is between 37 and 37.9 gravity. This grade has been cut from 61 cents to 34 cents, a difference of 27 cents. It is a 44 per cent cut.

The Stanolind company's prices affecting North and Central Texas range from 8 to 20 cents higher than its former prices in those fields. Since April 21 the prices of North and Central Texas crude had been uniformly 10 cents per barrel under the prices generally posted for Oklahoma, Kansas, East Central Texas and North Louisiana and Arkansas, where oil was bought on a gravity basis. This change was occasioned by the fact that local refiners started buying oil under the regular market and the larger companies met their prices.

The Stanolind prices were met on June 1 by the Sinclair Refining Co., Pure Oil Co., Empire Pipe Line Co., Champlin Refining Co., Mid-Kansas Oil & Gas Co., Eason Oil Co., Standard Oil Co. of Kansas, Mid-Continent Petroleum Corp. and Continental Oil Co. The Magnolia Petroleum Co. on June 2 met the prices of the Stanolind so far as they applied to oil from 28 gravity upward but made a price of 22 cents for oil below 26 gravity, 23 cents for 26-26.9 gravity, and 24 cents for oil of 27-27.9 gravity. From that point upward to 40 gravity and over 1 cent was added for each degree. The Magnolia's price affects Kansas, Oklahoma, North Central and East Central Texas.

Stanolind's Statement

Accompanying the announcement of the reduction in prices came the following statement from R. S. Ellison, president of the Stanolind Crude Oil Purchasing Co.:

"During the past week purchasers of East Texas crude reduced their posted prices 30 cents per barrel, bringing 40 gravity crude down to 37 cents per barrel. Approximately 400,000 bbls. of crude per day is now being sold throughout the Mid-Continent Field, including East Texas, at about half what we have been paying. High gravity crude is being freely offered in East Texas today at less than 20 cents per barrel.

"We can not go on paying more for our raw material than is paid by our competitors. There can not be one price for them and another for us. Economic law rules alike the producer of crude and the marketer of gasoline. Existing low prices are the result of current overproduction and in our opinion will continue until that overproduction ceases. We will gladly pay better prices for crude the moment that economic conditions in the industry warrant our taking such a step."

On the same day the Vacuum Oil Co. posted new prices for Lockport, Louisiana, crude oil. This field comes under the Coastal Grade A and Grade B schedule of the companies buying oil there. The Vacuum found that it could not pay the prices and compete with others drawing oil from low priced fields and posted a price of 60 cents for Grade A, and 55 cents for Grade B crude, regardless of gravity. The Lockport Field produces about 7,500 bbls. a day. It is located in the Louisiana Coastal Field.

Effect on Big Pools

The Stanolind Crude Oil Purchasing Co.'s new schedule, if or when it becomes general, will give Oklahoma City operators an average price of 36 cents per barrel. The high grade oil in the Burbank Field, rich in lubricants, will be posted at an average of 34 cents per barrel but it is doubtful if much of it will be sold at that price. The high grade crudes of Tonkawa and Garber in Oklahoma, and in Sedgwick, Butler and Greenwood Counties, Kansas, are pulled down to 37 cents per barrel. The low grade oils of southern Oklahoma are reduced to 25 cents per barrel which is a lower price than that posted for Healdton crude back in 1915. The lowest posted prices ever before paid for Oklahoma crude was 39 cents for Bartlesville crude in 1906 and 35 cents for oil above 30 gravity in 1909, and 40 cents in the boom days of Cushing in 1915. From the middle of February to the first day of August of 1915, Oklahoma oil brought no more than 40 cents per barrel and much of it went for prices below that figure on privately made contracts. Healdton crude at the same time sold for no higher than 35 cents. The highest posted price ever paid for Kansas, Oklahoma and North Texas oil was $3.50 per barrel from March 20, 1920, to January 2, 1921, at which time independent refiners were paying 25 cents and 50 cents premium over the posted price.

At an average of 34 cents per barrel the value of Oklahoma-Kansas crude is reduced about $170,000 per day.

Case of Indian Leases

Seventy-five per cent of the oil wells in Oklahoma are on Indian land. At the present price of oil a very large majority of these wells will be operated at a great loss under present crude oil prices, yet producers may be afraid to shut the wells in completely for fear the Department of the Interior may consider such action an abandonment and attempt to take the properties over.

To obtain a decision in this matter, E. B. Reeser, president of the Barnsdall Corp., wrote to Secretary of the Interior Ray Lyman Wilbur setting forth the situation and asking the co-operation of the department in conserving the oil produced on these properties without danger of their being lost to their present owners. Mr. Reeser's letter was written before there was any thought of the big cut in price that took effect on Monday. Secretary Wilbur's favorable reply to Mr. Reeser's letter was the suggestion that applications be forwarded to the Secretary of the Interior through the superintendents of the local Indian agencies in any cases it is desired to close in small producing wells temporarily and that such applications, if submitted, will be considered with a view of reaching a practical solution of the situation. Doctor Wilbur's letter follows in full:

"Washington, D. C., May 25.

"Mr. E. B. Reeser,
"President Barnsdall Corp.,
"Tulsa, Okla.

"My Dear Mr. Reeser:

"I have your letter of May 20 relative to closing in temporarily rather than abandoning permanently small producing oil wells on Indian land.

"Our leases provide that they shall continue in force for a fixed period, usually ten years—five years in the Osage—and as much longer thereafter as oil or

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Must "Potential" Depress Crude Prices

Industry Deceived by 24-Hour Gauges When There Is Not Even Any Intention of Building Tankage for Output

By J. Elmer Thomas
Petroleum Analyst, Fenner & Beane*

The statement is frequently made in controversies over proration that curtailing crude oil production has resulted only in lowering prices. The trend of daily production levels and posted prices during the past year discloses at once the reasons for that statement, but a more careful examination of all the facts indicates that other underlying conditions must be taken into account.

The shut-in surplus of available crude, commonly referred to as "potential," is a factor on which we do not have any careful statistics. Dr. Joseph E. Pogue in his admirable paper on "Economics of the Crude Oil Potential,"[1] has attempted to measure the aboveground storage equivalent of the shut-in surplus, and for that purpose he has estimated the potential by deducting from the aggregate initial production annually the amount necessary to offset declines in old wells. The figures coincide closely with the estimates commonly used for the fields now under proration and they have been used for the purposes of this analysis.

Figure 1 is a simple graph of production, potential, inventories and prices for the past five years by months, which makes their relationship very clear. It is not offered as a complete barometer of the oil business, which must also involve gasoline stocks and prices, consumption trends and other factors, but it does illustrate two very striking points which warrant careful study.

Situation in 1929 and 1930

In 1929 both production and stocks were mounting rapidly although the aggregate potential showed no increase over 1928. Price levels advanced as splendid increases in the rate of consumption suggested that supply could be brought into balance with demand. The curtailment effort had resulted in holding the potential just below the 3,900,000 bbls. daily estimate for 1928, and the surplus supply was not demanding an immediate outlet.

In 1930 the curtailment of output was still more marked and inventories showed a notable reduction for the first time in 10 years, but unrestrained drilling activity developed a potential estimated at 11,000,000 bbls. This condition, aggravated by disappointing consumption and burdensome gasoline stocks, forced price reductions last fall in no way related to the decline in daily crude production, which was considerable.

At the beginning of this year crude output was back to the levels of four years ago and inventories down to the figures of two years ago. Statistically the industry appeared to be getting its house in good order but actually potential supply was being built up more rapidly than ever before in history of aggressive drilling operations in East Texas, Oklahoma and California. Added to this depressing factor, and possibly in large part caused by it, was the insistent desire of certain low-cost flush producers to capture an increasing share of the market outlet, which was accomplished by the simple expedient of cutting prices.

Increases This Year

So far this year crude production has been increased some 400,000 bbls. daily and the surplus potential is probably nearing 14,000,000 bbls. daily and constantly mounting. Drastic crude price declines have resulted and large supplies are seeking a market at still lower quotations. The controversy over proration has reached an acute point and the whole program of balancing supply with demand is threatened. The present trend is towards still larger output at still lower prices though few can doubt that it will bring bankruptcy to a large part of the industry unless changed quickly.

Low prices are not a prompt corrective for overproduction already present and there is no effective method of controlling drilling. The only possible remedy lies in removing the desire or ability of temporary flush producers to dump large supplies below a fair price or even beneath actual cost of production. Unless this is accomplished immediately, a basic industry supplying a vital necessity faces chaos. It seems strange that there should be conflicting views on this point, and the controversy can only be explained by a disagreement over the fundamental causes of the present situation.

It seems evident that a fairly successful attempt to balance supply and demand resulted in an undue encouragement to drilling during the past several years. There is no inherent reason why that must have followed because demand can be predicted within reasonable limits and no one could have believed that increasing the supply would widen the markets. It was another application of the law of diminishing returns.

Policy of Balanced Program

On the other hand, it should be equally evident now that present large inventories and enormous potential production are no argument for abandoning the policy of a balanced program. For many years the oil industry has been conducted so that every barrel of crude was produced as rapidly as possible and marketed the same day it was produced, but there is no reason why this must be so.

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*Members, New York Stock Exchange.

[1] See The Oil and Gas Journal, February 26, 1931, page 25.

Substitute for Potential Production

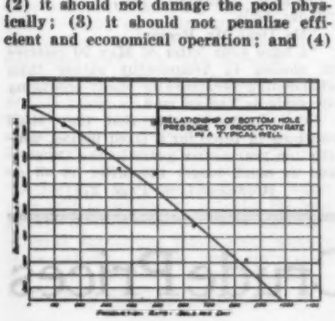
Method Suggested for Determining Production Allowances in Prorated Fields. Based on Pressure Drop in Producing Sand

By H. D. Wilde, Jr., and T. V. Moore
Humble Oil & Refining Co., Houston, Tex.*

DETERMINING PRODUCTION ALLOWANCES

In this paper a method for determining equitable allowable productions for wells in prorated fields is proposed. The system is based upon the pressure drop in the producing sand incurred by the flow of oil to the base of the well, and is offered as a substitute for the "potential production" determined by open-flow tests. The data required may be taken at low rates of flow, and the results do not depend upon the type of equipment in the well. A numerical illustration is given to show the application of this method.

There are, and there undoubtedly will continue to be, oil pools where it is either necessary or desirable to produce oil at a rate less than the maximum the pool is capable of producing. In such pools, it can be said that the production is curtailed. The reason for curtailing production may be to meet the market demand, to conform with a state-wide or nation-wide proration program established by governmental agencies; or it may be purely voluntary to decrease operation costs and increase the ultimate production. But whatever the reason for curtailing, there arises the problem of distributing or prorating the total production of the pool among individuals owning various parts of the pool. A satisfactory plan of distributing the production should have four characteristics: (1) It should be equitable to all owners; (2) it should not damage the pool physically; (3) it should not penalize efficient and economical operation; and (4) the allowances under it should be susceptible of rapid and accurate determination.



It is not easy to arrive at a definition acceptable to everyone of the term "equity." This is not surprising when one considers the present confused state of the law governing ownership of oil. Nevertheless, it is felt that the majority will agree that an equitable plan would allot to each owner a production rate that bears the same proportion to the total rate from the pool as the amount of recoverable oil underlying his surface property bears to the total recoverable oil in the pool. The main difficulty in developing such a plan is to find a simple measure of the recoverable oil under an owner's property.

The writers are presenting in this paper a method for distributing, or prorating, the total production from a pool which they believe meets the essential requirements. Before going into the details of the proposed method, a number of methods that are being used, or have been used, will be reviewed briefly, and the extent to which they fail to meet the essential requirements pointed out.

Existing Methods

Time basis—Perhaps the simplest manner in which the total production from a field can be distributed is on a time basis. Under this scheme, every well in the field is allowed to produce at its maximum rate for a given period of time, and is then shut in for another given period of time. The lengths of the producing and the shut-in periods are adjusted to give the desired total production. If all wells are equipped similarly, such a plan is reasonably equitable to the various owners, but there are several disadvantages to the plan. In the first place, it is generally conceded that the ultimate production under wide open flow will be less than if the wells are produced at lower rates. This is particularly true in fields where water can move in toward the wells. Consequently, production at the maximum rate is physically harmful to the pool. Large capacity lines, separators, meters and tanks are required to handle the full capacity production, and these facilities are used only a fraction of the time. This unnecessarily increases the investment in the well. Furthermore, the various owners would be encouraged to drill more wells than necessary, because the more wells on a given tract the greater production the tract will be allowed. This results in an excessive financial outlay. Because of these disadvantages, a method of distributing the production that provides for a steady rate of production from each well is preferable.

Acreage Basis

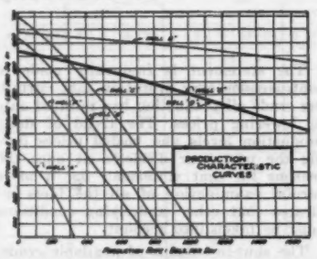
In some fields, the total production is distributed to the various owners on an acreage basis. On this basis, each owner produces at a steady rate a fraction of the total production equal to the fraction that his productive acreage bears to the total productive acreage. Such a basis is satisfactory provided the pay sand (or lime) and the distribution of the recoverable oil are uniform over the entire area of the field. But in most pools there is a variation in the thickness of the pay sand, in its porosity, permeability and saturation; and all these factors affect the amount of recoverable oil underlying a given property. Consequently, a plan of distribution based on acreage alone in many cases is not equitable to all property owners. Owners whose acreage overlies thin, or tight, or partially saturated pay sand are given a greater allowance; and owners over rich, thick, open, or fully saturated pays are given less than they deserve.

"Potential Production" Basis

Another method of prorating the production from a pool is based on the amount of oil the wells will produce on open flow, which is termed the "potential production" of the wells. According to this plan, each owner is given an allowance that bears the same ratio to the total production from the pool that the total of the open flow tests of his wells bears to the total of all open flow tests in the field. This plan assumes that each owner is entitled to produce in proportion to his capacity to produce, and that the open flow test is a measure of this capacity. Unfortunately, the open flow test is materially affected by the size of tubing or casing used in the well, the size and length of the surface flow lines, the depth of the well and the gas-oil ratio. Furthermore, by drilling additional wells, the total open flow production test of a property is increased. The open flow test is a measure of the capacity of a property to produce in its existing condition, but it is not proportional to the amount of recoverable oil under a property. Consequently, it does not distribute the production equitably as defined in this paper. As the drilling of additional wells is encouraged, and as the wells must be equipped with flow lines, separators, meters and tanks of sufficient capacity to handle the production under open flow, operating costs are unnecessarily high. An operator is encouraged to equip his wells in such a manner that the open flow tests will be as large as possible without regard to efficient operation. The open flow test itself is objectionable, because even during the short time that the well is allowed to flow wide open it can damage the well physically, particularly in water-drive fields. Thus, a method based solely on open flow tests fails to meet most of the requirements set out for a satisfactory method.

Acreage and Maximum Capacity Basis

A method widely used at present is based on both an acreage and maximum capacity basis. The pool or field is divided up into a number of units of equal area. The average potential production of the unit is determined by summing up the potential production of all wells on the unit and dividing by the number of wells. A definite portion, usually 25 per cent of the total production from the field, is divided equally among the various units. The balance of the total production (75 per cent) is distributed among the units in proportion to their average potential. As the average unit potential is a fairly good, if not absolutely accurate, measure of the recoverable oil under the unit, the method is reasonably equitable. It also has the advantage that the drilling of more than one well to a unit is discouraged, since in most cases the additional wells do not increase the average unit potential and do not increase the unit allowance. The disadvantage of the plan is the open flow test of the wells and the evils associated with it. This should be repeated at intervals. Furthermore, an operator is more concerned with getting large open flow tests than with efficient recovery of oil. The installation of efficient equipment is frequently accompanied by an unjust reduction in production allowance.



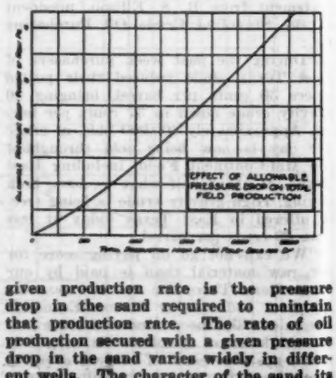
Existing Methods Do Not Fully Meet Requirements

It is seen that the methods just discussed all fail to satisfy fully the four requirements enumerated at the beginning of this paper. It is felt that these desirable characteristics are more nearly met in the last method outlined than in any of the others. This method is being successfully used in many fields today, and is being adopted in many of the newly prorated fields. In the plan proposed in this paper, an attempt is made to retain the desirable features of this method, but to substitute for the open flow test a measure of the productivity of the property that can be determined without injury to the pool and that does not discourage efficient production practice. This measure is based on the relation between the rate at which oil is produced and the pressure differential set up in the producing formation. Before presenting the details of the method, the aforementioned relation will be discussed briefly.

Bottom-Hole Pressure Relationship

When a well is shut in, the pressure at the base of the well is equal to the rock pressure, that is, the pressure in the surrounding formation (the base of the well is considered to be that part of the well that is drilled through the producing sand or lime). In order to produce the well, the pressure at the base of the well must be lowered, and the pressure differential thus set up between the base of the well and the surrounding formation causes oil and gas to move to the well bore. The lower the pressure maintained at the base of the well, the greater is the force that drives the oil to the well and, consequently, the greater the production rate. As pressure differential depends upon the pressure at the base of the well, in any given well there should be a definite relation between the pressure at the base of the well and the rate of oil production. Investigations carried on in wells in West Texas, North Texas and the Gulf Coast, including wells in lime, in consolidated sand, and in unconsolidated sand, with and without water drive, have demonstrated that such a relation does exist. The curve presented in Figure 1 is typical of the curves obtained showing how the quantities are related.

In order to minimize the effect of experimental error, a smooth curve is drawn through the points obtained by actual measurement, and the production rate corresponding to a given bottom-hole pressure is read from this curve. For the purpose of this paper, rock pressure is defined as the bottom-hole pressure corresponding to zero rate of production. Its value may be read directly from the curve. The difference between rock pressure and the bottom-hole pressure at any given production rate is the pressure drop in the sand required to maintain that production rate. The rate of oil production secured with a given pressure drop in the sand varies widely in different wells. The character of the sand, its porosity, permeability and thickness, the extent to which it is saturated with oil,



(Continued on Page 280)

*Before division of production, American Petroleum Institute, Dallas, Tex., June 2, 1931.

Refineries in East Texas Expanding

Six Plants to Be Refining Approximately 35,000 Bbls. of Crude Oil by Middle of Month

By C. O. Willson

All of the refining organizations with operating plants in the new East Texas fields directly or through affiliated companies have refinery interests in other areas. All are classed as independent refiners who have operated one or more plants in the Mid-Continent Field for several years. In all cases, the operating companies are affiliated with companies or individuals which are either producing now in East Texas fields or have development work under way. In some cases the plant projects were made possible due to the necessity of securing outlets for production owned by independent producers.

F. W. Burford who is president of the East Texas Refining Co. which built the first plant in the field and recently started operating a second plant, is president of the Burford Oil Co. which operates a 6,000-bbl. refinery at Pecos, Tex. Previously, Mr. Burford was vice president and general manager of the Crystal Oil Refining Corp. which operated a refinery at Shreveport, La. He was also connected with the sales department of the Skelly Oil Co. for several years. General offices of the Burford and East Texas companies are located in the Allen Building, Dallas, Tex.

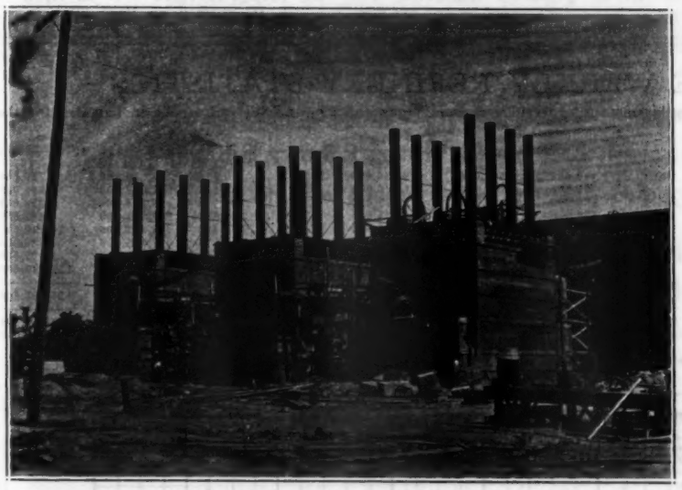
E. F. Griswold and R. E. Bishop, officials of the two companies are in charge of sales. Mr. Griswold has been connected with Mid-Continent refinery operations for several years and formerly was an official of the Griswold Oil Co. and the Pecos Valley Refining Co. which operated refineries in Texas. Mr. Bishop before joining the East Texas organization was sales manager of the Crystal Oil Refining Corp.

J. J. Thomas is vice president, in charge of the two East Texas company refineries. He holds a similar position with the Burford company and formerly was in charge of refinery operations for the Crystal corporation.

The Henderson, Tex., plant of the East Texas company, the first to be completed in the field, has been in operation approximately three months. Part of the equipment used was moved from the Pyote refinery of the Pecos Valley Refining Co. which has been dismantled.

The plant of the skimming type has a capacity of 6,000 bbls. of crude oil daily and is averaging in excess of 5,000 bbls. daily. The plant is located on the L& G.N. Railroad and the plant's fuel oil output is sold under contract to the railroad company. As in the case of all plants located in the East Texas fields, the Henderson plant output consists o. gasoline, kerosene, distillate, gas oil and fuel oil.

The first unit of the Longview, Tex., plant of the East Texas company was completed six weeks ago and a duplicate unit will start operating this week. Each unit will have a capacity of 6,000 bbls. and it is expected that the plant will handle from 10,000 to 12,000 bbls. daily on a skimming basis before the middle of the month making a total of 15,000 to 17,000 bbls. daily for the two plants. Each unit of the Longview plant consists of a pipe still and bubble tower and the Henderson plant has one unit of the same type. Approximately 50 per cent of the Longview fuel oil output will be purchased by the Santa Fe Railroad. This railroad and the Texas Pacific Railroad serve the refinery. Company owned pipe line systems gather and transport the crude oil from the fields to the plants.



View of Tyler, Tex., refinery of the Taylor Refining Co. which will start operating this week. The two units on the right are crude topping stills with a capacity of 7,500 bbls. daily each. The still on the left is a cracking unit with a capacity of 10,000 bbls. daily.

E. L. Rogers, formerly superintendent of the Continental Oil Co. refinery at Albuquerque, N. M., was appointed superintendent of the Longview refinery last month.

Taylor Company

The Taylor Refining Co. which this week started operating the largest refinery in the East Texas area, last year built and is now operating a refinery at Taylor, Tex.

The new plant which is located at Tyler, Tex., on the Cotton Belt Railroad has two 7,500-bbl. skimming units and one 10,000-bbl. cracking unit of the Rowsey type. The skimming and cracking operations are combined. The company expects to secure a yield of at least 45 per cent gasoline based on the crude oil charge. The gasoline yield from the cracking operation is comparatively small but the unit has large capacity and will materially reduce the viscosity of the fuel oil which from an ordinary skimming operation is over 100 cold test. The Taylor company has contracted the fuel oil output of the Tyler refinery to the Cotton Belt Railroad. Crude oil is brought to the plant in a line owned by the Tyler Pipe Line Co.

G. L. Rowsey who built the Tyler and Taylor refineries is president of the Taylor company. He has been connected with Mid-Continent refinery operations for several years. He served as manager or superintendent of plants owned by the Miller Petroleum Co., Amarillo Refining Co., Pampa Refining Co. and Great West Refining Co. He was in charge of construction when the last two named companies built their plants.

Headquarters of the Taylor company are located at Taylor, Tex. Wilbur Cahoon, for several years in charge of the North Texas sales office of the Cities Service Export Oil Co. and the Carson Petroleum Co. recently was appointed sales manager of the Taylor company. J. L. Bryan formerly connected with the Great West Refining Co.'s refinery at Big Springs is superintendent of the Tyler refinery. Mac Kennedy has been appointed division manager of the Taylor company with headquarters in Tyler. General sales will be handled from the Taylor office and local sales for East Texas at the Tyler office.

Built Twentieth Plant

When the Overton Refining Co., Inc., started operating its 3,000-bbl. refinery at Overton, Tex., late in May, it was the twentieth plant to be built and operated by J. B. Wrather. Mr. Wrather has built skimming plants in practically every major field which has been discovered in the Mid-Continent area in recent years. His policy has been to build small plants just as soon as a field is definitely proven. Inexpensive equipment is used and the operation is handled with the view of paying off the investment plus a profit during the flush period of field production. Several plants built by Mr. Wrather have been dismantled and moved to new locations after fields have passed the flush period in production.

The Overton company is a subsidiary of the Amarillo Producers & Refiners Corp. of which Mr. Wrather is president. The Amarillo corporation at present is operating a refinery at Oklahoma City, Okla., and is also interested in the Roosevelt Oil Co. with a refinery at Mount Pleasant, Mich.

The Overton refinery at present is skimming 2,000 bbls. of crude oil daily and this will be increased to the capacity of 3,000 bbls. daily. Most of the products will be sold in the Overton territory including the fuel oil all of which is now being sold as field fuel for drilling operations. P. H. Hertzog of the Amarillo Producers & Refiners Corp. with headquarters at 305 Oklahoma Savings Bank Building, Oklahoma City, will also sell the products of the Overton refinery. John Wrather is superintendent of the plant which consists of a pipe still and bubble towers.

Mr. Wrather has completed plans for the construction of a plant similar to that of the Overton company at Gladewater, a new producing section of the East Texas area. It will be known as the Gladewater Refining Co., Inc.

Mr. Wrather and associates are interested in proven leases in the Overton and Gladewater areas and it is expected that production from wells now drilling will furnish crude oil for plant operations. At present crude oil is being purchased from other producers and brought to the refinery at Overton by pipe line. The plant is located on the I.&G.N. Railroad.

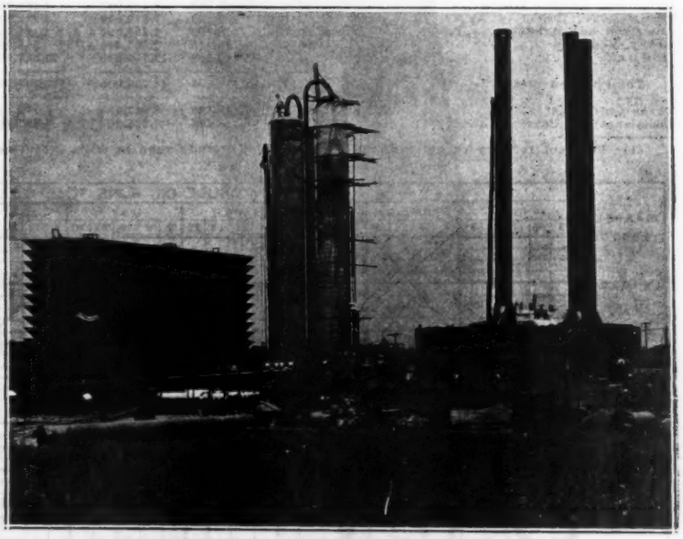
Beacon Plant

H. W. Roberts, owner of the Falls Refining Co. which has operated a refinery at Wichita Falls, Tex., for several years, is secretary-treasurer and general manager of the Beacon Oil & Refining Co. which recently completed a 4,000-bbl. skimming plant near Henderson, Tex. This plant is the only one in the field using shell stills for distillation.

T. B. Cannon who was superintendent of the Falls refinery is vice president and general superintendent of the Beacon plant. R. B. Williams is plant superintendent. This plant which was built in 49 days is now refining 2,000 bbls. of crude oil daily which is brought to the plant from nearby fields in the company's pipe line system. The plant is located on the I.&G.N. Railroad.

The Falls company specializes in the manufacture of special naphthas and the Beacon plant was designed so that these products can be refined. At present, the domestic grades of gasoline, kerosene, distillates and fuel oil are being refined. The fuel oil output is being sold as fuel in the fields and a large part of the gasoline output is being distributed locally. Tank car sales are handled by the Falls company. James E. Parker, an independent producer, operating in the East

(Continued on Page 52)



View of Longview, Tex., refinery of the East Texas Refining Co. The plant consists of two pipe still topping units, each with a capacity of 5,500 to 6,000 bbls. daily. The second unit will start operating this month. The company also has a 6,000-bbl. topping unit at Henderson, Tex.

Unit Plan Operation at Kettleman Hills

Distribution of Products Worked Out After Much Study. Details of Methods Under North Dome Association Agreement

By L. L. Brundred
Brundred & Brundred, Petroleum Engineers, Los Angeles, Calif.

Under the unit operation plan at Kettleman Hills two eliptical lines were drawn on the map of the field. The inner line bounds the presumably proven productive area and is intended to approximate the contour line 6,500 feet below sea level on top of the "Temblor" formation. The area represented may never be decreased, but may be increased by expansion of the inner line to follow the 6,500-foot contour, where such contour is proven productive outside of the present location of the line. The outer limiting line is intended ultimately to approximate the productive limits of the field and at all times to define the maximum area of participation. This line may be moved every year after five years up to and including the tenth year, at which time it becomes fixed and, for all intents and purposes, the inner line ceases to exist. The true location of the outer line must be determined by a compulsory exploratory drilling program specified in the agreement under which the association was formed.

Acreage inside of the limiting line, if proven nonproductive during the first five years, may be reduced in participation according to a fixed schedule set out in the agreement. After five years it may be completely excluded, without further participation. Acreage once proven productive may never be completely excluded from the association, but may be reduced in participation if it later becomes nonproductive. The agreement under which the association was formed specifically sets forth that all decisions pertaining to the movement or re-location of the lines, or changes in participation shall be by vote of two-thirds of the whole number of directors.

The total acreage inside of the limiting line amounts to 21,200 acres, one of the largest oil fields in the country. Out of this, the Standard Oil Co. owns 9,460 acres in fee. Originally the acreage contemplated for inclusion under the association amounted to 11,749. The actual acreage under the control of the association today amounts to 10,800. On January 31, 1931, five companies holding leased fee lands, representing a total of 410 acres, signed the documents conditionally, giving the association the right to take them over if the landowner's consent was secured. In each case consent could not be secured and therefore the option was never exercised. The remaining 530 acres of fee lands leased by five different companies refused to join the association.

Of the 10,800 acres at present comprising the lands operated by the association, fee lands amount to 1,160 acres; government "A" leases, 3,260 acres; government "B" leases, 6,260 acres; and permits, 120 acres. In addition, the association controls certain nonparticipating lands comprising 3,800 acres lying outside of the limiting line.

Form of Association

There are 14 members of the association. The total percentage owned by the so-called major companies, that is, members with pipe lines, refineries, etc., is 32.12 per cent. It is interesting to note that the balance, 67.88 per cent, is owned by strictly producing companies. The largest percentage owned by any one company is slightly in excess of 23 per cent, and the smallest just a fraction under 1 per cent.

Each member has one vote for each acre. Nine hundred sixty-eight acres are required to elect one of the 11 directors specified by the by-laws. Cumulative voting for directors is permitted. This permits three of the companies each to have two directors.

The association, as stated in the preamble, is a nonprofit organization. All funds are secured by budgeted calls, whether for development, operation or other expense. It should be borne in mind that the association does not own the land. It has merely contracted to take over the operating rights of the members. All of the physical equipment was purchased. Wells, drilling equipment, roads, pole lines, water wells and all equipment of any nature whatsoever requisite to the operation of the properties. Gasoline plants, because owned largely by nonmember companies, were not included in the properties taken over on April 1.

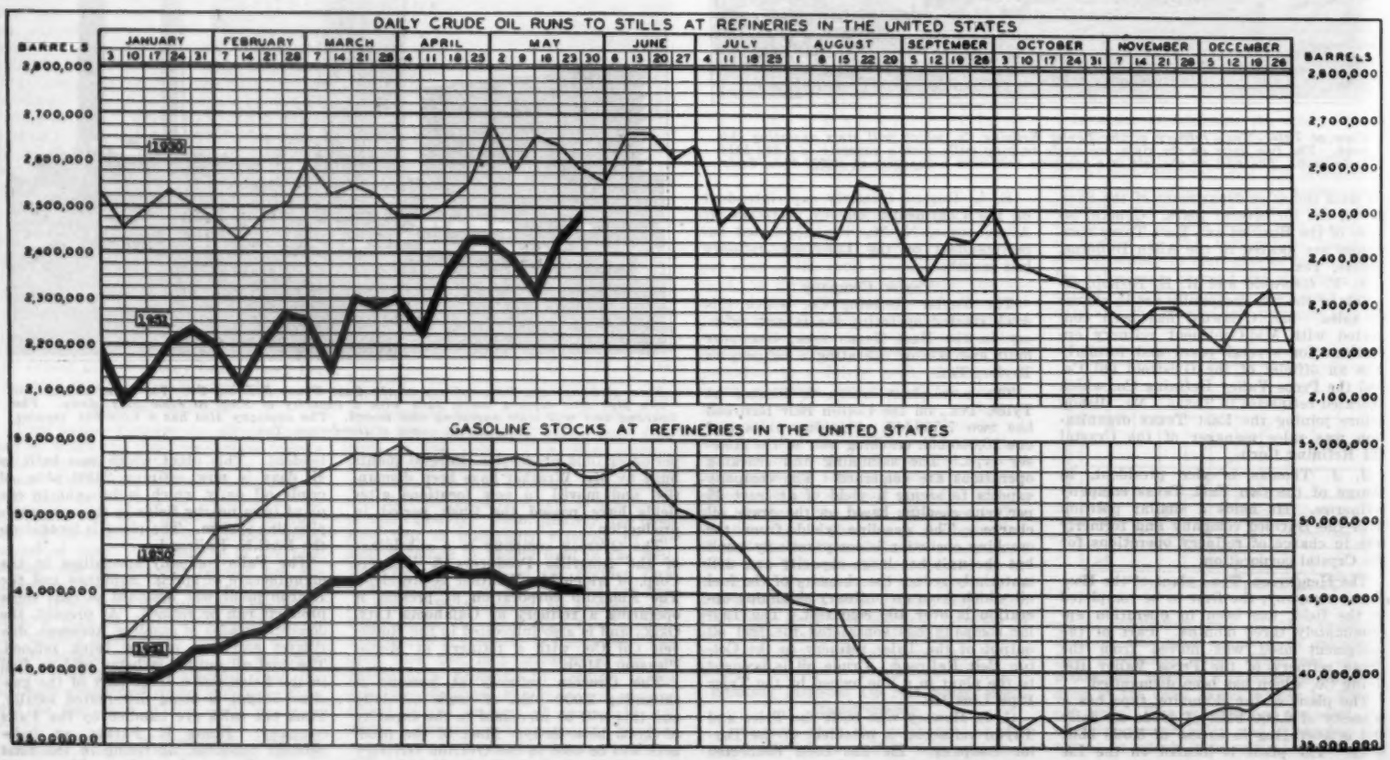
(Continued on Page 281)

AMERICAN PETROLEUM INSTITUTE WEEKLY REFINERY STATISTICS

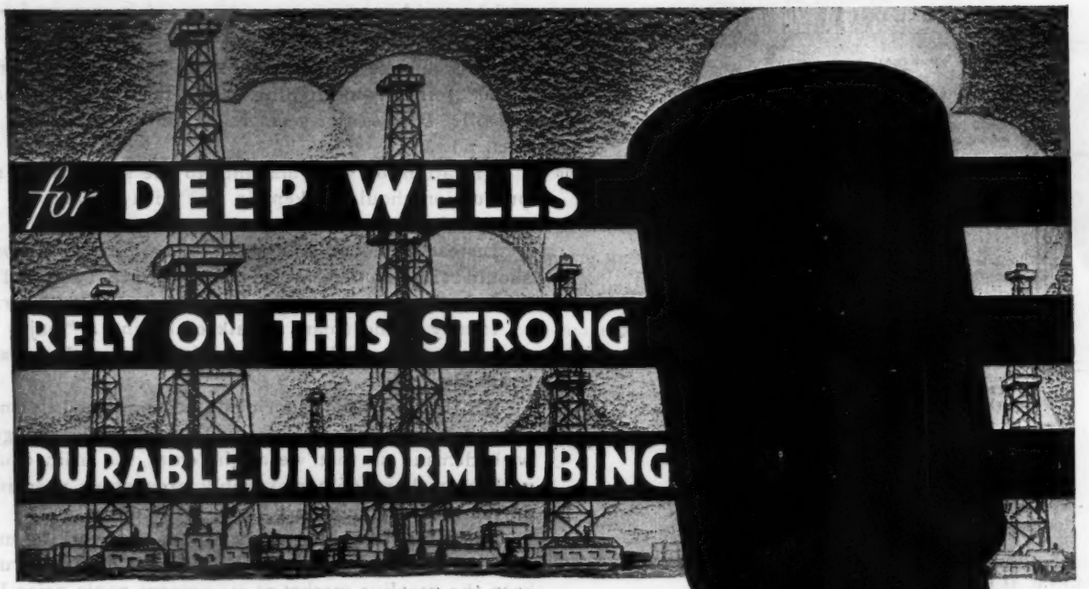
The weekly report made to the American Petroleum Institute on refinery statistics—crude runs to still, gasoline stocks and gas and fuel oil stocks in barrels—for the week ending May 30.

	Week ending May 30				Week ending May 23				Week ending May 31, 1930			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
East Coast	100.0	496,700	3,267,000	3,738,000	100.0	485,000	3,414,000	3,530,000	100.0	480,570	9,039,000	7,729,000
Appalachian	93.5	96,600	1,600,000	1,140,000	93.5	91,400	1,652,000	1,036,000	91.0	85,143	1,807,000	835,000
Indiana, Illinois, Kentucky	97.5	324,700	6,386,000	3,784,000	97.5	336,700	6,432,000	3,671,000	99.6	326,713	8,356,000	3,896,000
Oklahoma, Kansas, Missouri	89.4	276,000	3,645,000	4,264,000	89.4	273,300	3,664,000	4,225,000	89.8	310,570	4,861,000	4,442,000
Texas	91.9	575,400	7,840,000	9,380,000	91.9	560,200	8,154,000	9,583,000	90.8	572,430	7,423,000	10,240,000
Louisiana and Arkansas	98.3	176,200	2,383,000	2,427,000	98.3	160,100	2,336,000	2,389,000	96.8	174,570	2,495,000	1,835,000
Rocky Mountain	93.1	48,100	1,905,000	843,000	93.1	60,300	1,894,000	853,000	93.6	62,710	2,787,000	1,127,000
California	98.8	480,900	13,769,000	98,387,000	98.8	469,700	13,902,000	98,218,000	99.3	553,430	15,948,000	107,389,000
Total United States	95.7	2,474,600	44,795,000	129,463,000	95.7	2,441,700	45,449,000	128,555,000	95.8	2,566,136	52,715,000	137,593,000
Texas Gulf Coast	100.0	438,400	6,642,000	6,977,000	100.0	419,400	7,011,000	6,795,000	100.0	422,300	6,205,000	7,458,000
Louisiana Gulf Coast	100.0	113,400	2,226,000	1,491,000	100.0	104,900	2,198,000	1,467,000	100.0	119,350	2,087,000	989,000

(1) Per cent refinery capacity represented. (2) Daily crude runs to stills. (3) Gasoline stocks. (4) Gas and fuel oil stocks.



Data for 1931 based on weekly reports of the American Petroleum Institute. Figures for last week not shown in graph but are included in above tables.



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Lubricants from Cracked Distillates

Polymerization Will Permit Manufacture of Superior Oils With Yields to Make Commercialization Attractive

By F. W. Sullivan, Jr., V. Voorhees, A. W. Neeley and R. V. Shankland
Standard Oil Co. (Indiana)*

PRODUCTS HAVE HIGH VISCOSITY INDEX

Refiners have sought various means to improve the quality of their motor oils and considerable progress has been shown within the past three years. The Standard Oil Co. (Indiana) has investigated the practicability of making lubricating oils from cracked distillates. This plan provides a base stock of low wax content, and the subsequent processing yields an oil of exceptionally favorable characteristics. The products made and described here show an unusually good viscosity index. The study was carried on using pure hydrocarbons for comparison and as a guide to influence increasing or decreasing the proportion of certain types of hydrocarbons, during the manufacture of the lubricants.

It is well known that all commercial hydrocarbon lubricating oils are mixtures of many different kinds of molecules, varying in molecular weight, hydrogen-carbon ratio, and doubtless in the number of rings and degree of branching of the chains. It is highly improbable that any of these accidental mixtures can be so desirable for lubricating purposes as some of the individual components thereof, indeed, it is quite probable that certain hydrocarbons not present in petroleum would be better than any of those occurring naturally. With the possibilities of synthetic chemistry confronting him, the petroleum chemist should no longer be content with what nature happens to provide.

Obviously the most important characteristic of lubricating oils is viscosity, and since most lubricants are used under varying conditions of temperature, it is important that viscosity vary as little as possible with temperature change. The effect of temperature on the viscosity of an oil, or its temperature coefficient of viscosity, is a fundamental property of the hydrocarbons of which it is composed, and only a major change in the composition of the oil will markedly change it in this respect. Dean and Davis have proposed a useful method of indicating the temperature coefficient of viscosity of a commercial lubricant by the "viscosity index," which expresses the relation of its temperature coefficient to those of certain natural oils. The class of natural oils having the lowest coefficient is rated as 100 on this scale and oils with higher coefficients receive lower ratings.

Mineral oils having low temperature coefficients of viscosity, low vapor pressures for a given viscosity, and low densities are said to be paraffinic, and those at the other end of the range are said to be naphthenic. These terms will be used throughout this paper. These properties are inseparably related, from which it would be inferred that they are the common result of the presence in the oil of a certain type of hydrocarbon.

Analytical methods have not thrown much light on the constitution of mineral lubricating oils, nor have they indicated the relations between constitution and physical properties. Mabery has found that paraffinic oils have a higher hydrogen-to-carbon ratio than naphthenic oils. In general, it seems that a high hydrogen-to-carbon ratio is a concomitant of desirable paraffinic properties.

Monoolefins of the empirical composition C_nH_{2n} possess a higher hydrogen-to-carbon ratio than any mineral lubricants. They are readily available and numerous investigators have shown that they may be readily polymerized by aluminum chloride or other means to viscous oils. The known fact that natural lubricating oils vary in properties and the reasonable belief that such variations are due to differences in chemical constitution, together with the knowledge that olefins can be polymerized to viscous oils and the expectation that relations between constitution and properties should be evident, provided the basis of this work. Investigation of the polymerization products of many typical olefins has shown that the properties of these polymers are very closely related to the constitution of the starting materials. After determining the raw materials which yield the best lubricating oil, it has been possible to develop sources of such materials and to carry through the phases in the manner which will be described.

Although many investigators have worked on the general subject of polymerization, few have determined the properties of the products which are significant from the modern point of view, especially the temperature viscosity relationship, none of the above-mentioned authors has described the results of a comprehensive investigation which has related properties to chemical constitution or which has disclosed any practicable method of synthesizing oils more paraffinic in nature, or better in general quality, than natural oils. This goal has now been attained.

In his work on the polymerization of cracked distillates from Pennsylvania gas oil, Brownlee used about 2 per cent by weight of aluminum chloride at 300-400° F. Starting with these conditions, it was found that lower temperatures were better from the standpoint of yield of viscous oil, and, in general polymerizations were conducted at temperatures between 70° and 200° F. Slight variations in polymerizing conditions had but little effect on the quality of the polymerized product. On the other hand, it appeared that the properties of the products of polymerization of different unsaturated materials varied greatly. Accordingly, several normal olefins and isoolefins and typical representatives of cyclic unsaturated hydrocarbons were polymerized.

The apparatus used in many of the experimental runs consisted of a 6-liter cylindrical autoclave placed in a vertical position and provided with an anchor-type agitator, a thermometer well, a pressure gauge, and plugs in the top and bottom. Other small-scale experiments were made in 4-gallon steel cylinders mounted on trunnions like a churn and heated by an internal steam coil. Semiwork experiments were conducted in a 2-bbl. jacketed kettle agitated by a centrifugal pump arranged to circulate the reacting mixture from the cone bottom to the top of the kettle. This later design was followed in principle on the large scale and has proved quite satisfactory.

In order to obviate the possibility of small differences due to variations in polymerizing conditions, a procedure was standardized as closely as possible and is exemplified by the following illustration. A solution of 420 grams of amylene in 3 liters of naphtha, rendered inert by previous aluminum chloride treatment, was agitated with 75 grams of aluminum chloride for 8 hours at 135° F. At the end of this time the product was allowed to settle, sludge was separated, and the supernatant solution of oil, after being washed successively with sodium hydroxide solution and water, was reduced with fire and steam to the desired viscosity. The oil obtained by hydrolysis of the aluminum chloride sludge was inferior in all respects. This fact is confirmed by the results of Stanley, and Nash, Stanley and Bowen, who found that as the temperature of polymerization of ethylene with aluminum chloride was increased the yield and quality of "combined" oil diminished. All the olefins were polymerized in naphtha solution except cetene, which was agitated with aluminum chloride at 135° F. in the absence of any diluent. Most of the olefins were made by the dehydration of the corresponding alcohol over alumina. Cetene was made by the thermal decomposition of spermaceti or cetyl alcohol.

Experimental Results

The results of the experiments with pure olefins are given in Table 1. In general, it appears from this table that in the case of normal olefins, with increasing molecular weight of the raw material, the temperature coefficient of viscosity decreases. Although the polymerized oil from cetene had a lower temperature coefficient of viscosity than any of the other synthetic oils, it had a high pour test. Investigation showed that this high pour test was not due to the presence of a small amount of high melting wax, but rather that it was a natural characteristic of the entire synthetic product, which evidently had a fairly high melting point. This apparently happens only in the polymerization of olefins containing very long straight chains. In the case of isomeric olefins the change of viscosity with temperature increases as in the case of normal butylene compared with isobutylene.

The oils obtained by polymerization of cyclic olefins, cyclohexene and turpentine, possessed to an extreme degree the properties of naphthenic oils and, in fact, showed higher temperature viscosity coefficients than any naturally occurring naphthenic oil. The oils from these cyclic olefins, as well as that from ethylene, possessed low A.P.I. gravities, whereas all the other synthetic oils were characterized by approximately the same high gravity. These results expose in a rather striking manner the fallacy of placing too much reliance on gravity as an indication of the other characteristics of a lubricating oil. Thus it can be seen from the table that two oils of similar viscosity may have the same A.P.I. gravity and

(Continued on Page 284)

TABLE 1—POLYMERIZATION OF PURE OLEFINS

Olefin—	Viscosity of product[1] 100° F. (37.8° C.) Sec.	Viscosity of product[1] 210° F. (98.9° C.) Sec.	Yield of oil Wt. %	Viscosity index[2]	Gravity ° A.P.I.	Pour test ° F.	Pour test (° C.)
Ethylene	2,769	90		—150	18.0		
Propylene	1,883	76	33.3	20	33.1	—10	(—23)
Butene-1	1,654	92		50	34.2	—10	(—23)
	1,122	78	46.4				
Butene-2	1,507	81	33.3	21	34.7	—5	(—20)
Isobutylene	3,704	147	42.0	67			
	1,540	94			32.5	—10	(—23)
	868	73					
Pentene-1	1,350	94	59.8	82			
	1,180	89			33.2	—15	(—26)
Pentene-2	1,948	98	38.5	87	32.8	0	(—18)
	976	68	53.0				
3-Methylbutene-1	3,301	108	50.8		34.0	5	(—15)
	938	65					
	521	50					
3-Methylbutene-1	1,959	89	34.5	11	33.7	5	(—15)
	993	68					
Trimethylethylene	1,476	70		—74	31.0	25	(—4)
	367	49	29.3				
(Isoamyl chloride)	2,354	87			24.6		
Hexene-1	1,155	92		91	34.3	—25	(—32)
Octene-1	905	88		104	34.6	—20	(—29)
Cetene	1,774	101	85	138	33.9	45	(7)
	1,127	153			34.8	45	(7)
	717	108			35.9	40	(5)
Cyclohexene	2,135	85		—27	18.0	25	(—4)
Turpentine	4,750	83		—324	15.8	30	(—4)

[1]The viscosity figures in all tables are Saybolt Universal viscosities.
[2]The viscosity index (see Dean and Davis (21) of each oil was calculated for a viscosity of 85 at 210° F.

TABLE 2—POLYMERIZATION OF CRACKED DISTILLATE FROM VARIOUS STOCKS

Stock cracked—	Boiling range of distillate polymerized ° F.	Viscosity of product 100° F. Sec.	Viscosity of product 210° F. Sec.	Visc. index	Yield of oil Wt. %	Pour test ° F.	Gravity ° A.P.I.
Winkler gas oil	225-500	3,650	86	—172	17.9	—15	18.4
Shale oil	320-420	2,420	84	—64	19.6	—15	14.5
Wax-free Mid-Continent gas oil	300-500	1,500	86	41	50.5	5	28.6
Oleic acid	Init.-300	1,420	87	52	48.0	—10	23.4
Pa. mineral seal	300-500	1,275	86	63	51.3	—5	26.8
Ozokerite	300-500	914	85	97	16.5	—35	26.0
70% wax from sweat oil	300-500	835	84	103	50.0	—35	30.8
Paraffin wax (122-140° F.)	Init.-428	797	85	109	45.0	—10	33.1
High melting pet. wax (172° F.)	300-500	735	87	118	55.0	—35	31.3

TABLE 3—EFFECT OF WAX CONCENTRATION ON SYNTHETIC OIL

Stock—	Boiling range of distillate polymerized ° F.	Yield of oil Wt. %	Viscosity of product 100° F. Sec.	Viscosity of product 210° F. Sec.	Visc. index[1]	Gravity ° A.P.I.	Pour test ° F.
Wax-free Mid-Continent gas oil	300-500	50.5	1,500	86	41	28.6	5
40 per cent wax	300-500	46.5	1,030	87	90	28.5	..
65 per cent wax	Init.-530	42.2	804	77	90	29.4	—15
70 per cent wax	300-500	50.0	825	84	103	30.8	—35
75 per cent wax	Init.-536	44.2	840	83	99	30.9	—15
85 per cent wax	Init.-496	51.0	750	83	107	31.8	—20
95 per cent wax	Init.-530	64.1	675	86	123	34.0	—15

[1]In this and subsequent tables each viscosity index was calculated directly from the viscosities given.

*Part of paper presented before American Chemical Society and published in June issue of Industrial and Engineering Chemistry.

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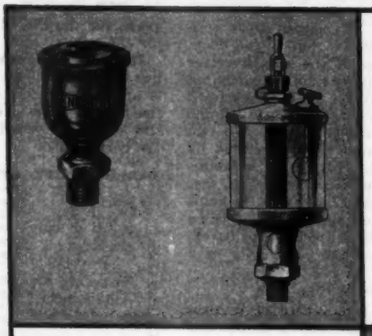

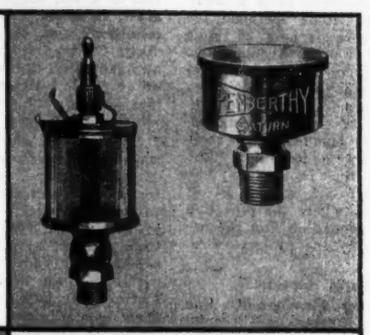

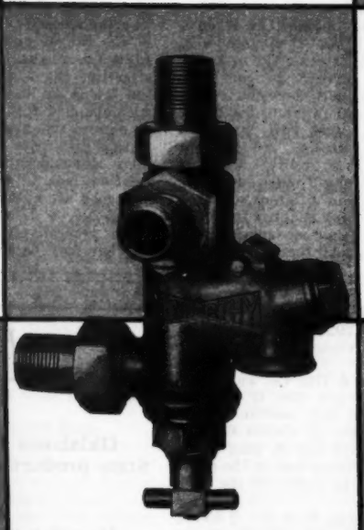

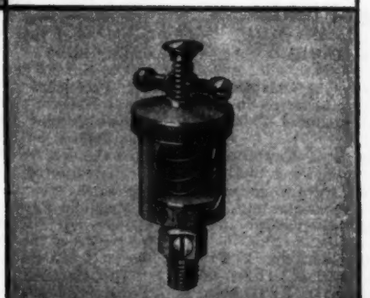

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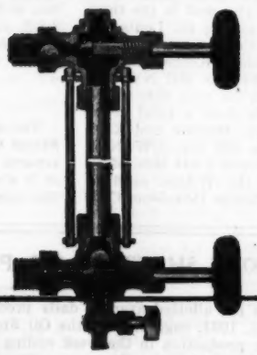

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Soil Corrosivity Surveys of Great Value

Essential Features of a Number of Tests for the Corrosiveness of Soils in Various Parts of the Country

By K. H. Logan
United States Bureau of Standards*

Within the last few years there have appeared in the technical press a number of articles describing methods for determining the corrosiveness of soils with respect to old or proposed pipe lines. Some of these articles are rather inaccessible to those who are remote from large technical libraries, and brief descriptions of some of these methods, together with a few comments on their essential features, may be helpful to those interested in pipe line protection. The purpose of soil-corrosion survey is, of course, to determine where the pipe line in question needs protection and the extent and character of the protection required.

Limitations of Surveys

So far as the rate of corrosion of a line at a given location depends solely upon the characteristics of the soil in that location, a soil corrosivity survey may be successful. Too much, however, should not be expected from it. Anyone who has examined trenches or cuts along roadways has noticed that usually the soil is not uniform, but changes rapidly in both vertical and horizontal directions. These changes include variations in degree of oxidation, moisture content, amount of soluble salts, acidity, and texture. Any test in a soil subject to wide variations must, therefore, either represent average conditions and, consequently, fail to indicate the highest rate of corrosion to be anticipated, or represent a very local condition, with little indication as to what may happen within a few feet of the test location.

While it has been shown that for short specimens the rate and character of their corrosion depend upon the soil type or series, there is reason to believe that the corrosion at certain points on a long line is accelerated because the line passes from a soil of one kind to a soil of a different kind. There is also evidence indicating that the depth of the burial of a line and the way in which the trench is backfilled influence the rate of corrosion. It has been shown that when a new line is connected to an old one, or when a line is connected to an oil storage tank, an electric current flows on the line. The circuit of this current is completed through the earth, and corrosion occurs at the points where the current leaves the line for the soil. Just how important these factors in corrosion are has not been determined. It is probable also that different kinds of pipe corrode at somewhat different rates in different soils, the material which is best adapted for some soils being not as good as another material in other soils. All these things indicate that it is not possible to predetermine accurately the rate of corrosion of a pipe line.

The Bureau of Standards 1930 soil-corrosion data indicate that if the deepest pit in any one of the six Bessemer steel specimens from one soil is compared with the deepest pit on the best specimen of the group, the average ratio of the two pits for all groups is 1.75. No two specimens in a group were separated by more than 9 feet. The ratio indicates that although a pipe is punctured in, say, 10 years, it may last 17.5 years at a point not more than 9 feet distant. This is an indication of the best precision to be expected in predicting the corrosivity of a soil.

Variations in Pipe Life

Table 1, which is a record of failures of three parallel lines, shows in another way the variations which can be expected in the life of pipe at any one location. Line No. 2 was laid about seven years after line No. 1, and nine years prior to the laying of line No. 3. The lines are within a few feet of each other. It will be noticed that there is frequently a very marked difference in the lives of the three lines at one location, as for example at location No. 1, where line No. 1 was still good after 39 years, while lines Nos. 2 and No. 3 showed lives of 15 and 14 years, respectively.

What may be the effect of connecting a new line to an older one is shown by the average lives of the three lines, which are 26.6 years for the oldest line, 21.3 years for the No. 2 line and 17.1 years for the newest line.

It has been observed that when a new line is laid beside an older one, the former is anodic, or is the corroding element in the battery formed by the two lines and the soil. This condition may accelerate the corrosion of the newer line.

TABLE 1—LIFE OF 8-INCH OIL LINES

Location—	Life of line in years— No. 1	No. 2	No. 3
1	39+	15	14
2	38	32+	14
3	39+	13	20
4	19	22	23
5	17	15	13
6	17	13	11
7	19	13	12
8	20	17	23+
9	20	14	16
10	19	22	20
11	36	29	14
12	37	30	21
13	33	32+	17
14	23	31	22
Average	26.6	21.3	17.1

While it has been shown that the two lines only a few feet apart may differ by 100 per cent in rates of corrosion, there is also evidence that if several lengths of pipe are considered, there is a rather definite relation between the location and the life of the pipe, as is indicated in Table 2 which shows the life of sections

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*Before Division of Production, American Petroleum Institute, Dallas, Tex., June 4, 1931. Publication approved by Director, Bureau of Standards (United States Department of Commerce).

Late Fields

OKLAHOMA

The production of the Oklahoma City Field on June 1 was the lowest in several weeks. The field produced 49,003 bbls. from 50 wells.

During the month of May the Oklahoma City Field produced a total of 4,942,510 bbls. of oil, an average of 159,437 bbls. a day. It was the largest production the field has yielded in any month.

Tom Slick Oil Co.'s No. 2 Frisco, NE cor. NW SE, Section 3-11-3w, Oklahoma City Field, made 2,834 bbls. of oil the first two hours with 62,000,000 feet of gas a day. The total depth of the well is 6,369 feet. The well is the third producer completed on the St. Louis-San Francisco Railway Co.'s property in the Oklahoma City Field. Keene-Okla Oil Co.'s No. 1 Ohio, NE cor. SE NW SE, Section 15-11-3w, on the west side of the field, was bailing in from a total depth of 6,475 feet. Payne, Johnson and Kemnitz' No. 1 Wright, SE cor. NW NW, Section 10-11-3w, flowed 1,344 bbls. of oil in one hour from the Wilcox sand at 6,385-6,540 feet. Phillips Petroleum Co.'s No. 1 Perry, NW cor. NE SW, Section 10-11-3w, flowed 5,292 bbls. of oil in four hours from the Wilcox sand at 6,395-6,524 feet.

Mid-Kansas Oil & Gas Co. and Ramsey Petroleum Corp.'s No. 6 Preston-Culp, NW cor. NE NE, Section 6-5-9w, in the Cement Pool, in Caddo County, was drilling at 7,646 feet in gray shale. It is the deepest drilling test in the State and is expected to be drilled to the Wilcox sand.

Magnolia Petroleum Co.'s No. 2 Estes, SE cor. SW NE, Section 10-5-9w, on the east edge of the Cement Pool, was drilling at 4,845 feet.

The Carr City Pool in the Greater Seminole district is one of the active areas in that part of the State. Prairie Oil & Gas Co. and Tom Slick Oil Co.'s No. 6 Hyde, NW cor. SE NW, Section 3-8-5, swabbed 175 bbls. of oil in 17 hours from the Wilcox sand at 4,160-65 feet.

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MAGNETIC STORM

The magnetic observatory of the United States Geodetic Survey at Tucson, Ariz., reports a severe magnetic storm started at 9 o'clock (Central Standard time) on the morning of June 1.

SCORE SHEET ON OIL PRODUCTION

Below is shown the allotted average daily production in the United States from April 1 to October 1, 1931, suggested by the Oil States Advisory Committee, and the actual daily average production in the week ending May 30:

	Barrels			
	Allotted	Actual	Over	Under
Oklahoma	550,000	527,435	.....	22,565
Texas	714,000	965,083	251,083	.....
California	500,000	538,750	38,750	.....
Kansas	110,000	106,710	.....	3,290
Arkansas	50,000	46,245	.....	3,755
Louisiana	65,000	68,555	3,555	.....
New Mexico	40,000	46,229	6,229	.....
Rocky Mountain area	60,000	54,190	.....	5,810
Eastern states	110,000	111,000	1,000	.....
Total	2,199,000	2,464,197	300,617	35,420

Net average daily overproduction, 265,197 bbls.

High Spots in Field News

OKLAHOMA

Oklahoma City Pool has 100,000-bbl. well in north end of field. State production falls 15,000 bbls.

SOUTHWEST TEXAS

New gas sand opened in Laredo area by well in extreme south end of Cole and O'Hern-Seacord Pools.

GULF COAST

Operators cut production and three deep wildcat tests are abandoned. Victoria County shows much activity.

NORTH LOUISIANA-ARKANSAS-MISSISSIPPI

Hinds County, Mississippi, has 30,000,000-foot well. Zwolle most active in North Louisiana. Urbana Field, Arkansas, extended.

WEST TEXAS

Good oil showing in Schleicher County test may open new pool. Ector County test, northeast of Penn Pool, may open another.

CALIFORNIA

State's production to be reduced to 427,500 bbls., outside Kettleman Hills, which will be permitted to produce 60,000 bbls. daily.

KANSAS

New proration law in effect. Flush field producers protest not getting fair share of crude market. New line to Ritz-Canton area.

ROCKY MOUNTAIN AREA

San Juan County, New Mexico, active. Renewed interest in Greasewood Dome, Colorado. Osage Field, Wyoming, extended.

EAST TEXAS

Completions may soon reach 100 a week instead of 100 a month average since Joiner Field was discovered. Six hundred wells drilling and 700 on production, with 140 new locations last week. Humble, Magnolia and possibly Shell to lay additional lines. Lack of pressure causing speculation on production.

Oklahoma City Gets 100,000 Barrel Well

Phillips Petroleum Co. Completes It in Northern End of Field. Oklahoma Production Falls 15,000 Bbls.

By W. A. Spinney
Staff Correspondent, Oklahoma Fields

Oklahoma's production continued to decline during the week ending May 30, when the daily average was approximately 527,500 bbls., a decline of 15,000 bbls. a day from the previous week. Some express the opinion the State's production may decline to approximately 500,000 bbls. during the coming week owing to the slacking demand for Oklahoma crude notwithstanding the favorable action of the Oklahoma Corporation Commission in recommending an increase in the allowable output for the Oklahoma City Field.

The Oklahoma Corporation Commission extended proration in the Oklahoma City Field from June 1, to July 1, under the old plan, allowing 6 per cent of the potential production from the field under the same plan that has been effective in the pool. The Wirt Franklin petition was taken under advisement.

After a two-day hearing before the Corporation Commission witnesses for both sides outlined the plan dividing the Oklahoma City Field into four zones and for an increase in the allowable production from the wells from 160,387 bbls. to 181,193 bbls. a day with the production apportioned on the proposed basis, from the four different producing horizons. Witnesses for the operators in the northern part of the field testified that all wells in the field get their oil from one common source of supply, and that a well in one formation might drain oil from another sand level, and that proration on a basis of the different sands would be unfair to owners of many producing wells. It was brought out in the testimony that the loose sand formations separating the horizons outlined in the Wirt Franklin petition, in some cases might permit such drainage.

The Corporation Commission in advising Wirt Franklin that his petition would be taken under advisement pointed out it was a question that was never before presented, and if granted might lead other fields in the State to seek similar orders for the protection of certain sands or limestones from water encroachment. The Wirt Franklin petition called for an increase of allowable production from the present 160,387 bbls. to 181,193 bbls. a day. Crude oil purchasers estimated prospective purchases would total approximately 187,000 bbls. a day during the next four months.

The efforts of Wirt Franklin to divide the Oklahoma City Pool into four separate horizons and place them on a different proration basis was opposed by attorneys for the Independent Oil Producers Association, composed of 29 companies. Both sides declared they wanted proration continued. Effort to delay action on the proposal was defeated when the commission voted to continue the hearing, the first day.

Wirt Franklin in explaining his proposed plan, decleared that the water has practically taken the production in the lime area in the field and the purpose of the proposed petition was to prevent destruction of the oil resources in the lower Simpson sand horizon, such as has taken place in the lime area.

100,000 Bbl. Well

What is believed to be the largest well ever completed in Oklahoma came in in the north end of the Oklahoma City Field in the past week. It is estimated at better than 100,000 bbls. of oil a day. The well is Phillips Petroleum Co.'s No. 1 McBeth, NW cor. SW NE Section 10-11-3w. It gauged 9,400 bbls. of oil in 2 hours and 15 minutes on a potential test. The oil was found in the Wilcox sand at a total depth of 6,411 feet. The gas is estimated at 50,000,000 feet a day. Some express the opinion that the reason the production is so large is that the 9-inch casing was landed at 6,310 feet. There was no 6-inch casing run into the hole.

Another large well in the Oklahoma City Field was Oil, Inc.'s No. 1 Ross, SE cor. NW NW Section 2-11-3w, which was completed some time ago at the rate of 114,000 bbls. a day on an 18-minute gauge. The well was credited with a production of 55,329 bbls. of oil on the potential gauge taken in the field.

On May 1 the Phillips Petroleum Co. was credited with a potential gauge of 1,541,230 bbls. of oil a day from 40 completed and 31 drilling wells in the Oklahoma City Field. A number of the wells had a potential of 50,000 bbls. a day.

The Indian Territory Illuminating Oil Co. on May 1 was credited with a potential gauge of 1,764,963 bbls. a day from 302 wells and the Tom Slick Oil Co. with 1,024,864 bbls. a day from 141 wells already in and 14 drilling wells.

Tom Slick Oil Co.'s No. 1 Terminal, NW cor. SE NW Section 3-11-3w, flowed 770 bbls. of oil in 30 minutes, with an estimated 40,000,000 feet of gas a day, from the Wilcox sand at 6,335-6,546 feet. Phillips Petroleum Co.'s No. 1 Henderson, NW cor. NE Section 10-11-3w, flowed 1,800 bbls. of oil in one hour with an estimated 35,000,000 feet of gas a day. The well was produced through a 4-inch choke with 150 pounds back pressure. The oil was found in sand from 6,312-6,475 feet.

City Drilling Restrictions

A petition for the extension of the oil drilling zone inside the city limits of Oklahoma City was filed with the capital city planning commission during the week. The request for the extension was northward to Sixth Street. The territory in the proposed extension zone lies between Fourth and Sixth Streets and Missouri Avenue. It is the second request the city planning commission has received to include the territory in the drilling zone.

The city planning commission was also asked to change the requirements of the drilling regulations which require a $200,000 bond with each well developed inside the city limits. A committee was appointed to consider the change. The petitioners stated this regulation worked a hardship on the smaller oil companies. The State Supreme Court recently upheld the requirement.

The total recovery of oil from the Oklahoma City Field up to May 31 was given as 61,965,230 bbls. of oil. The total recovery figures reveals that during the last five months approximately 20,000,000 bbls. of oil has been produced from the field, which is almost one-half of all the oil that was produced during the first two years.

The last potential estimate taken on April 1 shows the Oklahoma City Field has a rated potential of 8,019,345 bbls. of oil based on four-hour gauges. The potential is divided into five different producing horizons as follows: The Arbuckle lime pool, 128,101 bbls. from 72 wells, an average of 1,779 bbls. per well; lower Simpson sand pool, which adjoins the Arbuckle lime area on the west, and includes the so-called Johnson sand, School Land sand, and others in which many of the wells are showing water, 2,295,936 bbls. a day from 429 wells, which is an average of 5,351 bbls. per well; North Wilcox sand pool, north and northwest of the lower Simpson sand pool, a body of sand averaging better than 100 feet in thickness, where from three to seven wells have been drilled on each 10 acres, 4,880,229 bbls. of oil from 138 wells, an average potential of 35,363 bbls. per well.

The South Wilcox Pool is the most southern producing horizon in the field and it is separated from the North Wilcox sand pool by a distance of about 2½ miles. The wells were drilled not to exceed one in the center of each 10 acres. The area has a potential production of 647,849 bbls. of oil from 62 wells, an average potential of 10,449 bbls. per well.

The potential production east of the fault line in the Oklahoma City Field was 17,231 bbls. a day from six wells, a daily average potential of 2,871 bbls. per well.

Market for Oklahoma City Crude

The companies purchasing oil in the Oklahoma City Field have announced their nominations for the next four months beginning June 1. The Sinclair-Texas Pipe Line Co. will buy 50,000 bbls. of crude daily during June, July, August and September. The Oklahoma Pipe Line Co., which has been taking from 13,000 to 15,000 bbls. a day, has reduced its nominations to 6,000 bbls. a day for June, July, August and September. The Stanolind Crude Oil Purchasing Co. also reduced its takings about one-third. In June it will take 18,000 bbls. a day; July, 20,000 bbls. a day; August from 30,000 to 35,000 bbls. a day, and in September 30,000 bbls. a day. The Indian Territory Illuminating Oil Co. will continue to purchase approximately 2,250 bbls. of oil a day until June 7, and will then withdraw as a purchaser altogether. Empire Oil & Refining Co. will take 33,000 bbls. a day during the next four months, which is an increase of approximately 3,000 bbls. a day. The Shell Pipe Line Co. will continue to take approximately 12,000 bbls. a day. The nominations of the other purchasers in the field will remain about the same as at the present time.

Old Wells Worked Over

The Indian Territory Illuminating Oil Co. is working over and testing a group of old wells that are producing from the lower Simpson sand horizon, and which have been suffering from water encroachment during the last few months. The company's No. 1 E. Butterfield, SE cor. NE NE, Section 11-11-3w, an old producer at a total depth of 6,540 feet after being plugged back swabbed 257 bbls. of oil in 24 hours and the next day's gauge was 241 bbls. Same company's No. 1 Coppinger, NE cor. NW, Section 11-11-3w, was cleaning out at a total depth of 6,600 feet, and made 240 bbls. of oil in 24 hours. No. 4 Coppinger, NW cor., Section 11-11-3w, was cleaning out at a total depth of 6,529 feet. No. 6 Coppinger, NW cor. SW NW, Section 11-11-3w, made 938 bbls. of oil in 24 hours from a total depth of 6,549 feet.

The company's No. 4 Clarence E. Trosper, SW cor. NE, Section 14-11-3w, an old producer, was being mudded off after flowing 1,362 bbls. of oil and considerable water. The company's No. 1 Mount Vernon Heights, NE cor., Section 15-11-3w, swabbed 740 bbls. of oil in nine hours from a total depth of 6,629 feet. These wells were completed some time ago and will probably be plugged back in an attempt to shut off the water which has been appearing in that part of the field.

Important Wildcats

Ute Oil Co.'s No. 1 Williams, C SW, Section 23-12-24w, Roger Mills County, was shut down at a total depth of 4,830 feet. In the same county, L. C. Hivick and others' No. 1 Davis, C NW NE, Section 4-11-26w, has been fishing at a total depth of 2,956 feet.

In Beckham County, Price and McFann's No. 1 Webster, C SW SW, Section 34-8-26w, made 1,500,000 feet of gas after being plugged back from a total depth of 2,344 feet to sand at 1,890-1,900 feet and shot with 60 quarts, and completed. Carson and others' No. 1 Dency, SW cor. SE NE, Section 20-8-22w, an old well drilling deeper, was shut down at 1,790 feet. B. B. Morris has secured a new lease on the W half NW, Section 26-9-23w. Magnolia Petroleum Co. has released tracts of acreage in Section 23, 24, 25, 35 and 36-7-25w, and in Section 26, 27, 33 and 34-9-25w, all in Beckham County.

In Grady County, J. V. Nichols and others' No. 1 Williams, SW cor. SE, Section 24-4-8w, was spudding. In the next section Margay Oil Co. and others' No. 1 Carson, NW cor., Section 25-4-8w, made 1,500,000 feet of gas at a total depth of 2,260 feet with a rock pressure of 620 pounds.

The Western Production Co.'s No. 1 Gable, C NE, Section 24-4-13 (Cimarron meridian), Texas County, in the Oklahoma Panhandle, was spudding. It is located near what is believed to be the south end of the Hugoton gas field ex-

(Continued on Page 50)

WILDCAT OPERATIONS IN OKLAHOMA

(Descriptions are East and North unless marked otherwise)

NORTHERN OKLAHOMA

ALFALFA COUNTY

Company, farm and location—	Remarks:
Smith Brothers' No. 1 Forbes, SE cor. NW NW Sec. 12-27-11w	Shut down 1,232 ft.
J. W. Bailey's No. 1 Acre, SW cor. NE Sec. 14-24-11w	Drlg. 5,460 ft.

BECKHAM COUNTY

Price-McFann's No. 1 Webster, C SW SW Sec. 34-8-26w	T. D. 2,344 ft.; plugged back to 1,890-1,900 ft.; 1,500,000 ft. gas completed.
Mid-Continent's No. 1 Schaff, C NE SW Sec. 22-11-22w	Waiting on cement to set 430 ft.
Mid-Texas Co.'s No. 1 Sidell, NE cor. SW SW Sec. 17-2-22w	Shut down 2,550 ft.
White et al's No. 1 Green, SW cor. Sec. 34-10-24w	Shut down 3,575 ft.

BLAINE COUNTY

Washoma Oil Co. et al's No. 1 Phillips, C NW SW Sec. 13-19-10w	Drlg. 4,740 ft.

CADDO COUNTY

Abernathy & Brown's No. 2 Houston, Sec. 24-6-13w	Shut down 1,115 ft.

COAL COUNTY

McGraw Oil Co.'s No. 1 Ward, NE SE Sec. 35-1-8	Drlg. 1,217 ft.
Whitney et al's No. 1 Miller, SE NE Sec. 10-2-8	Shut down 760 ft.

COMANCHE COUNTY

G. W. Stegner's No. 1 Doebel, C SW SW Sec. 3-3-9w	Shut down 1,450 ft.
J. R. Travis' No. 1 Pickett, NE cor. Sec. 3-1-11w	Shut down 900 ft.

GARFIELD COUNTY

E. L. Love et al's No. 1 White, SE cor. NW Sec. 9-24-6w	Shut down 5,850 ft.

GARVIN COUNTY

Malarnee et al's No. 1 Phillips, NE SW SE Sec. 24-2-2w	Drlg. 3,108 ft.
Skinner's No. 1 Elrod, SW cor. Sec. 13-2-3	Shut down 1,120 ft.

(Continued on Page 243)

Four million barrels more of cracked gasoline!

Two million barrels less of straight-run gasoline!

Nine hundred thousand barrels less of natural gasoline!

That is the way a committee of the American Petroleum Institute sizes up the demand for gasoline for the period April 1 —October 1, 1931

Isn't that significant?

It means that the motorist is demanding gasoline of better and better knock rating It

means the wise refiner will crack more and run less crude to his stills

That's fine for the Dubbs refiner He can make gasoline that is outstanding in any market and make it from cheapest charging stock at lowest cost

Universal Oil Products Co
Chicago, Illinois

Dubbs Cracking Process
Owner and Licensor

Kansas Flush Field Producers Protest

Claim They Are Not Being Given a Fair Share of the Crude Market. New Proration Law in Effect

By W. A. Spinney
Staff Correspondent, Kansas Fields

The new Kansas proration law became effective May 28 upon publication in the statute book. The conservation act is to be administered by an umpire or a committee of oil operators, or by an umpire working under a committee. It is expected to be decided at the meeting between producers and members of the Kansas Public Service Commission, which was held in Wichita, June 2.

It is believed the commission is taking a broadminded view of the situation and it asks for expressions from operators affected by the ratable taking law.

Some of the operators at the meeting asked the commission to seek the reason why interests controlling the crude oil market outlet in the State and the petroleum prices insisted on holding the production of oil in the State of Kansas at a stationary level, while increasing the output in Oklahoma and in the East Texas fields.

Some of the independent operators express the opinion that the major purchasers of crude oil are discriminating against the Kansas oil producers. The meeting was called by Commissioner Thurman Hill, of the Public Service Commission of Kansas to discuss administration of the proration act.

Some express the opinion the State of Kansas has a potential of approximately 200,000 bbls. a day and the purchasing companies are taking around 106,000 bbls. a day. Nearly a dozen new pools in different counties have been found in recent months all of which have been shut in owing to the lack of a market outlet. The discovery wells are shut in and no further development has taken place.

Independent oil men said that Kansas was the only state that has voluntarily curtailed its production. Leasing activity is at a standstill and leases on many thousands of acres are being cancelled. The independent operators say they are willing to co-operate with the Public Service Commission to work out a statewide program that will assure Kansas of obtaining its just share of the crude oil market.

The state production for the week ending May 30 was 106,500 bbls. a day compared to 106,300 bbls. a day the previous week.

New Pipe Line to Ritz-Canton

The White Eagle Oil & Refining Co., a subsidiary of the Standard Oil Co. of New York, announced it would construct a new pipe line from the White Eagle refinery at Augusta in Butler County to the new Ritz-Canton Pool in McPherson County.

Construction work on the line is expected to start in about 90 days or possibly sooner. It will be approximately 70 miles long and it is estimated it will cost $500,000. Details of the construction work have not been completed, but White Eagle Oil & Refining Co.'s officials are expected to decide in the next 10 days on either a 6 or 8-inch line. A tentative survey will route the pipe line south from the Ritz-Canton Field, passing to the east of Moundridge and near Hesston in northern Harvey County. The line will continue on south to Valley Center in Sedgwick County, where it will turn east to a point about 5 miles north of Augusta in Butler County. There the pipe line will connect with the White Eagle Oil & Refining Co.'s 6-inch pipe line recently built to the Carter tank farm where the White Eagle Oil & Refining Co. has ten 55,000-bbl. storage tanks. From the Carter tank farm the oil will be carried to the refinery at Augusta.

It is believed upon the completion of the Ritz-Canton project the White Eagle Oil & Refining Co. may extend the pipe line to the west to the new producing areas in Rice, Stafford and Ellsworth Counties, where approximately 40,000 bbls. of oil is now shut in without a market outlet.

Two other pipe lines are being discussed as means of giving the Rice, Stafford and Ellsworth Counties a market outlet and the Voshell Pool, additional pipe line.

The Standard Oil Co. of Kansas, El Dorado Refining Co., Vickers Petroleum Corp. and others are carrying on negotiations for the building of a pipe line from the Ritz-Canton area to refiners at El Dorado and connecting with the Standard Oil Co. of Kansas pipe line near that point.

The Derby Oil & Refining Co. is also considering a pipe line project from its pipe line station near Burrton, in Harvey County, to its refinery at Wichita. The Derby Oil & Refining Co. has a 4-inch line from the Voshell Pool, in McPherson County, to a loading rack near Burrton, in Harvey County, where the oil is loaded into tank cars and shipped by rail to its refinery at Wichita.

Ritz-Canton's Big Potential

During the week the umpire in the Ritz-Canton area announced that owing to the increase in production from new wells with no increase in the market outlet the allowable would be reduced to 7 per cent of the potential. The market outlet remains at approximately 6,300 bbls. a day while the potential of the field has increased to approximately 95,000 bbls. a day. Eight completed wells in the area are still untested by the umpire. Potentials that have been taken total 73,895 bbls. of oil from 40-acre units. The combined well potential of the field is believed to be in excess of 95,000 bbls. a day. Potentials yet to be taken are, Phillips Petroleum Co.'s No. 1 Wiles, E. F. Jones' No. 1 Holmes, Syndicate Oil & Gas Co.'s No. 1 Becker, W. M. Lassen's No. 1 Hale, Lario Oil & Gas Co.'s No. 1 Wiggers and No. 1 Lagree; Stearns-Streeter Co.'s No. 1 Chindberg, and W. C. McBride, Inc.'s No. 1 Gustafson. These wells are expected to increase the potential of the area to better than 100,000 bbls. a day and approximately 50 other tests are drilling. Ritz-Canton wells range in potential from 100 bbls. a day to 6,700 bbls. a day, the production being found in the chat and the Viola formations.

One of the wells taking potential during the week was Phillips Petroleum Co.'s No. 1 Gratton, SW cor. SE, Section 19-19-1w, which made 115 bbls. of oil in 12 hours, giving the well a 230-bbl. potential in 24 hours. Lario Oil & Gas Co. and Shell Petroleum Corp.'s No. 1 Suffied, Section 25-19-2w, was given a potential rating of 2,710 bbls. of oil. It swabbed 1,355 bbls. of oil in 12 hours from the Viola at 3,395-3,414 feet. Vernon Oil & Gas Co.'s No. 1 Drum, NE cor., Section 35-19-2w, which was completed in the chat a short time ago is being drilled deeper to the Viola lime.

Decker Gas Field

Pipe lines are being laid to chat oil wells recently completed in the Decker gas area on the west side of production in the Ritz-Canton area. Stearns-Streeter Co.'s No. 1 Chindberg, in Section 15-19-2w, and W. C. McBride, Inc.'s No. 1 Gustafson, in Section 12-19-2w.

Another large gas well was completed in the Decker gas field during the week, the largest ever completed in the county. It was McPherson Oil & Gas Co. and Shell Petroleum Corp.'s No. 2 Meyers, C NW SE, Section 14-19-2w, McPherson County, estimated to be a 55,000,000-foot gas well from the chat. The well is believed to be approximately larger by 4,000,000 feet than any other previously completed in the area. The owners immediately staked two more locations, one for No. 3 Meyers, C NE SE, Section 14-19-2w, and No. 3 Giffin, C SE NW, Section 14-19-2w.

The largest gas well yet completed in the Decker gas field in McPherson County gauged 51,278,000 feet of gas in 24 hours. The McPherson Oil & Gas Development Co. and Shell Petroleum Corp.'s No. 3 Decker, C SE NE, Section 11-19-2w, found the gas in the chat at 2,891-2,939 feet. It was shut in without any difficulty. It first made 12,000,000 feet of gas from a total depth of 2,916 feet. The big gas was found in the last few feet in the chat. It is the thirty-eighth gas well completed in the Decker-Canton-Ritz area. The largest gas wells in the State were completed years ago in the old Elk City Field of Montgomery County. Wells completed in that field drilled about 10 years ago ranged from 1,500,000 to 80,000,000 feet a day. The new well in the Decker gas field brings the potential gas production of the Ritz-Canton-Decker area to over 600,000,000 feet of gas a day. The gas fields in McPherson County are now in second place in the amount of open flow from wells completed in the State, the Hugoton gas field ranks first in open flow production with an estimated production of 700,000,000 feet of gas a day.

At the close of the week ending May 29 a total of 108 wells were classified as drilling in 19 different counties in Kansas. McPherson County leads the State in development work with a total of 65 operations. Rice County had four operations; Ellsworth, Morris, Rush, Sedgwick and Sumner Counties had three each; Barton, Cowley, Reno, Russell and Greenwood Counties had two each; Graham, Marion, Ness, Norton, Rawlins, Stafford and Stevens Counties had one each.

The wildcat test of Gilmore Oil Co. in the southern part of Ellsworth County is being abandoned as a dry hole. The test was No. 1 Sturm, NW cor. SW, Section 31-17-9w. It was shot at 3,245-65 feet where a small showing was first found, but the shot did not increase the showing. The total depth of the test was 3,295 feet in Silicious lime, where a hole full of water was found. It was plugged back to the upper formation.

New Pool Opened

J. J. Hall and Stearns-Streeter Co.'s No. 1 Miller, SW cor. SE SE, Section 30-14-13w, Russell County, was drilled to a total depth of 3,012 feet and plugged back to the Oswald pay at 2,890-96 feet

(Continued on Page 265)

WILDCAT OPERATIONS IN KANSAS

(Descriptions are East unless marked otherwise)

Company, farm and location—	Remarks:
BARTON COUNTY	
Syndicate Oil Co.'s No. 1 Boertz, NW SE SE Sec. 13-18-12w	Shut down 2,440 ft.
Skelton Oil Co.'s No. 1 Ott, C SE SE Sec. 16-19-14w	Drlg. 2,230 ft.
McCool et al's No. 1 Tsern, NW SE NE Sec. 12-20-11w	Shut down 1,600 ft.
CHASE COUNTY	
Borden et al's No. 1 Atkinson, NW SE Sec. 18-18-7	Rig on ground.
Kline et al's No. 1 Elliston, C SE SE Sec. 21-19-6	Drlg. 583 ft.
CLAY COUNTY	
Crystal Oil et al's No. 1 Tivier, SW cor. Sec. 19-8-2	Shut down 2,500 ft.
COFFEY COUNTY	
Heyburg's No. 1 Kroft, SE SW SE Sec. 30-22-14	Drlg. 1,550 ft.
Roberts et al's No. 1 Hay, SW SE NW Sec. 32-22-15	Shut down 1,250 ft.
COWLEY COUNTY	
Leman et al's No. 1 Hill, SE NE Sec. 27-33-4	Drlg. 680 ft.
Fisher et al's No. 1 Hurt, C SW SE SE Sec. 11-34-2	Rig.
Roth & Faurot's No. 1 Reedy, SW NW NE Sec. 8-32-8	Shut down 1,040 ft.
DICKINSON COUNTY	
Severs et al's No. 1 Lavengood, NE SW Sec. 18-13-2	Shut down 3,850 ft.
ELLSWORTH COUNTY	
Gilmore Oil et al's No. 1 Sturm, NW SW Sec. 31-17-9w	Silicious lime 3,243 ft.; shut down 3,295 ft.; plugged back to 3,264 ft.
Hershey et al's No. 1 Schultz, C NE Sec. 9-14-8w	Underreaming 1,925 ft.
Aylward et al's No. 1 Stratman, SE NW SE Sec. 1-17-10w	Silicious 3,255-71 ft.; 117 bbls. 2 hrs.; shut in; est. 2,000 bbls.; no pipe line connection.
Aladdin Pet.'s No. 1 Stoddenberg, C SW Sec. 22-16-10w	Drlg. 1,725 ft.
Milton et al's No. 1 Kester, SE NE Sec. 6-14-9w	Drlg. 2,755 ft.
FORD COUNTY	
Carter Oil Co.'s No. 1 Everett, C NE Sec. 22-29-21w	Drlg. 3,795 ft.
Swain et al's No. 1 Taylor, C NW Sec. 21-25-24w	Drlg. 5,105 ft.
GRAHAM COUNTY	
Schleimeyer et al's No. 1 Clark, SW NE NE Sec. 11-9-25w	Drlg. 4,380 ft.
HARPER COUNTY	
Beeler et al's No. 1 Bear, C NE Sec. 21-36-6w	Shut down 1,830 ft.
KINGMAN COUNTY	
Skelly Oil's No. 1 Miles, NE cor. Sec. 30-27-10w	1,635-40 ft. 2,000,000 ft. gas; at 2,005-20 ft. 6,000,000 ft. gas; at 2,133-42 ft. 3,000,000 ft. gas; showing oil 3,385 ft.; T. D. 3,441 ft.; S. D.; estimated at 600 bbls. a day.
LYON COUNTY	
Sheedy et al's No. 1 Brown, C W half SE Sec. 10-20-11	Drlg. 2,050 ft.
MARION COUNTY	
Midwell's No. 1 La Master, NW cor. Sec. 21-22-4	Shut down 650 ft.
MORTON COUNTY	
Hydraulic Oil Co.'s No. 1 State Land, NW SE Sec. 22-34-43w	T. D. 3,640 ft.; shut down.
MORRIS COUNTY	
Urschel et al's No. 1 Bersuch, NW SE NW Sec. 10-17-7	Machine.
Hankerson et al's No. 1 Cessman, SW SE Sec. 24-16-9	Shut down 2,210 ft.
NESS COUNTY	
Gypsy Oil Co.'s No. 1 Coleman, C SW NE Sec. 25-17-25w	Fishing 4,690 ft.
NORTON COUNTY	
Richards et al's No. 1 Colby, Sec. 17-4-21w	Rig.
OSAGE COUNTY	
Briggs & Smith's No. 1 Wood, SE NW S.c. 21-14-15	Shut down 1,525 ft.
Fields' No. 1 Usker, SE cor. Sec. 35-16-17	Shut down 400 ft.
RAWLINS COUNTY	
J. G. Durham et al's No. 1 Weaver, SE cor. Sec. 3-2-35w	Shut down 3,200 ft.

(Continued on Page 263)

The BRIDGEPORT Shopper's PAGE

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A. A. BUSCHOW, *President*

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Also fish tail drill collars, all sizes. Write for descriptive Bulletin No. 2, for complete information.

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Also 8⅝", 8¾", 11", 12", 12¼" Single, 3-point Forged Steel Bridgeport Rotary Reamers.

Bridgeport Forged Steel Reamers are Specially Heat Treated, with Cutter Pockets Not Welded into the Body, have Large Bore, and are made of High-grade Nickel Chromium Steel. Ask for Bulletin No. 1, for full description.

Also standard sizes in cast steel single 3-point reamers.

QUICK REPAIR SERVICE

Special Equipment for Drill Pipe and Long Drill Collars

Our Wichita shop is equipped with a new 11" Lodge & Shipley Hollow Spindle Lathe. 24" swing. Immediate service on Drill Pipe and long drill collars. Our trucks travel between McPherson and Wichita almost daily, and we pick up repair work at our McPherson store, and return without charge on these trips. Cannot always guarantee immediate delivery however—only as regular trips are made.

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10,000 ft. 5⅛"—20 lb. Seamless Casing.
2,500 ft. 6⅝"—24 lb. Seamless Casing.
4,200 ft. 8¼"—32 lb. Seamless Casing.
1,800 ft. 10"—40 lb. Seamless Casing.
1,000 ft. 15½"—70 lb. Seamless Casing.
10,000 ft. 2" Regular Line Pipe.

AT WICHITA, KANSAS

1,600 ft. 6⅝"—25.2 Drill Pipe, Singles, with tool joints on. Guaranteed like new, at ..... **$1.50 per ft.**

1,500 ft.—3" Line Pipe.

AT OKLAHOMA CITY, OKLA.

700 ft. 6⅝"—25.2 Drill Pipe, Singles, with tool joints on. Guaranteed like new, at ..... **$1.50 per ft.**

4,000 ft. 6⅝"—25.2 Drill Pipe, Singles, with tool joints on. Worn but usable, only ..... **30c per ft.**

4,000 ft. 4" Drill Pipe, 16.6, Singles, with tool joints on. Excellent shape, at ..... **$1.00 per ft.**

Or delivered to any point in Texas, Kansas or Oklahoma, at.... **$1.10 per ft.**

1,600 ft. 6⅝" Casing, fine for line pipe or shallow string, at ..... **45c per ft.**

AT KILGORE, TEXAS

3,600 ft. 6⅝"—24 lb. Seamless Casing, Excellent Condition.

1,400 ft. 10"—40 lb. Lapweld, Good Condition, Bargain, at ..... **$1.25 per ft.**

1,500 ft. 12½"—50 lb. Lapweld, 600 ft. new, balance first class, at **$1.40 per ft.**

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At Kilgore, Texas, 3 used 1½ K. W. Steam Generators, shopped,

At ..... $75.00 each

Also 5 Garden Oil Burners, formerly sold for $150.00

At ..... $37.50 each

WE WILL BUY

Two good, used Wilson Snyder Rotary Pumps. Give location, full description as to condition, and price. Dependable Used Tool Dept., Bridgeport Machine Company, Wichita, Kansas. L.D. 59.

Mississippi Contributes Good Gas Well

Industrial Gas & Electric Co. Completion in Hinds County Produces 30,000,000 Feet. Urbana Field in Arkansas Extended

By J. R. Crumpton
Staff Correspondent, Louisiana-Arkansas

SHREVEPORT, La., June 1.—After a prolonged absence from the list of successful completions, Mississippi came through with a good gas well to head a small number of new producers in this division. The Industrial Gas & Electric Co. completed its No. 1 Illinois Central Railroad Co., Section 4-5-1, Hinds County, gauging 30,000,000 feet of gas from 2,468 feet. This is the forty-second gas well for Hinds and Rankin Counties, an area immediately surrounding Jackson, the capital city of Mississippi. Another test that is nearing the pay in Rankin County is Grandstaff and others' No. 1 Carr, Section 12-5-1, 6⅝-inch casing having been set at 2,368 feet. Atkinson & Dyer are rigging up their No. 1 Valentour, Section 18-5-2, in the same county and Cleve Love and others are shut down at 4,000 feet on their No. 1 Muse, Section 32-7-4.

The Gulf Refining Co., in Clark County, permanently abandoned its No. 1 Box, Section 11-2-15, at 4,515 feet, and the Ohio Oil Co. is progressing slowly with No. 1 Cantrell, Section 16-15-5, Clay County, having made less than 100 feet during the seven-day period. In Warren County, the Eagle Bend Oil Co. has set 12½-inch surface casing at 186 feet and drilling at 852 feet on its No. 1 Kiger, Section 9-18-2. One new location is reported from Mississippi with the rigging up of Thompson & Donohue's No. 1 Donohue, Section 25-16-17 in Noxubee County.

Arkansas Fields

A half mile northern extension of the Urbana Field of Union County by a 286-bbl. flowing well, was the feature of the week in the Arkansas fields. The extension producer is Wilson & Chapman's No. 1 N. Parker, Section 3-18-13, which is flowing from a depth of 3,565 feet. The operators' first test in this section one-half mile southwest, listed as their No. 1 Hadley, was temporarily abandoned at 3,570 feet with 600 feet of fluid in the hole, 30 per cent salt water, but four new locations have been made by them in the immediate vicinity of the new producer. The Marine Oil Co., one-half mile southeast of the Chapman & Wilson well, topped the sand at 4,546 feet and tested 4 bbls. of pipe line oil at 4,551 feet. The well will probably be deepened to increase the flow.

In Lafayette County, Arkansas, Smitherman & McDonald are drilling in black shale at 1,360 feet on their No. 1 Rogers, Section 17-15-22. The expected oil show from 1,198 feet, obtained in their first test in the adjoining section, did not materialize. The latter well, which had loomed as a possible south extension of the shallow Nevada County Field, was recently abandoned at 1,198 feet with 800 feet of fluid in the hole, one-fourth being oil and the remainder salt water. The No. 1 McGhee Planting Co., a recent test started in Section 5-8-7 in Lincoln County by Lawrence B. Cook, is drilling in gummy shale at 1,040 feet.

North Louisiana Fields

Zwolle continues as the most active field in North Louisiana, adding two flowing wells during the week, although neither appears in the completion list, due to not having been gauged for 24 hours. The producers, both in the southeast part of the field where the chief activity is now centered are W. M. Coates' No. 4-A Sabine Lumber Co., Section 1-7-12, flowing 200 bbls. daily from a depth of 2,297 feet, and Jordon Drilling Co.'s No. 2 Louisiana Long Leaf Lumber Co., Section 3-7-11, flowing by heads 150 bbls. daily from 2,455 feet. The Pelican Natural Gas Co., in the same section, failed to get a producer on its No. 9 Louisiana Long Leaf Lumber Co. and the hole was abandoned as dry at 2,671 feet.

Two tests some distance north of the Zwolle East Field were abandoned as failures. One was the Durham Oil Co.'s No. 1 Polley, Section 18-8-12, dry at 2,722 feet, and the other was John Woodley's No. 1 Sabine Lumber Co., Section 12-8-12, dry at 2,716 feet. Two wildcats were failures in DeSoto Parish when Dupree Fountain abandoned his No. 1 J. M. Nabors, Section 5-12-11, at 2,455 feet, and C. D. Neff's No. 1 Ramsey, Section 33-13-16, was dry at 3,081 feet. The only other completion in Louisiana was Nemours' Corp.'s No. 1 McGaugh, Section 24-22-3, Union Parish, gauging 3,197,000 feet of gas.

Several disappointments were registered in the border counties of East Texas during the last few days, particularly in Panola County, where The Texas Company's No. 12 Brumble, John Womack Survey, failed to prove a good gas well from the deep sand as had been expected. The sand was topped in this well at 4,742 feet with a small amount of gas showing, and after deepening to 4,751 feet, the completion stood as a 2,000,000-foot gasser making 800 bbls. of salt water. Another test in Panola, Everett Production Co.'s No. 1 McDaniels, Alanson Barr Survey, tested dry in the shallow sand at 1,315 feet after showing considerable gas through the drill stem. In Harrison County, William H. Atkinson topped the Georgetown lime high at 2,858 feet in his No. 1 Hays, J. H. Chaffin Survey, and the test was abandoned at 2,870 feet.

Sloan Well Again Interesting

Sloan Prospecting Co.'s No. 1 Windham, H. English Survey, in Shelby County, has again been the center of interest in that area during the last few days. Several weeks ago, a good looking sand was cored from this well at 2,669 feet where 6-inch casing was set, and the test following showed both gas and oil but not in commercial quantities. After deepening, a broken chalk formation showing oil was encountered from 3,334-57 feet and from 3,389-99 feet. Liner was set and the well bailed, resulting in it making several heads of oil and mud, and afterwards producing practically pure gas. After a short interval, the well sanded up and the operators are arranging to use a sand pump.

Although the incentive for opening up new fields is not encouraging, due to overproduction and the naturally resulting low prices of crude oil, the drilling operations in this division are not decreasing to any appreciable degree. In North Louisiana, there are 80 rigs and drilling wells as compared with 79 for April. Of the 25 completions, 11 were dry, 5 were oil wells with only a combined initial production of 2,553 bbls., and 9 were gas wells with a combined output of 201,861,000 feet. Arkansas completed only 8 tests, 7 of which were dry with 1 producer making 250 bbls. A total of 37 rigs and drilling wells are operating in this State as compared with 37 for April. The seven East Texas counties on the border next to the Louisiana line have the most intensive wildcat drilling campaign of any area in this division, a total of 56 rigs and drilling wells looking for production. Three completions were registered in these counties, all of them being dry holes.

Daily Average Runs

A net decrease of 700 bbls. in daily pipe line runs was registered in the district during the week. Daily average runs for the several pools were:

NORTH LOUISIANA	
Caddo, light	7,205
Caddo, heavy	2,760
Homer	3,220
Haynesville	5,690
DeSoto-Red River	2,650
Elm Grove	505
Bellevue	570
Cotton Valley	1,860
Urania	4,450
Pleasant Hill	420
Sarepta-Carterville	1,250
Zwolle	7,550
Holly	515
Total North Louisiana	33,655
Total previous week	33,890
Decrease	235
ARKANSAS	
El Dorado	3,610
Smackover, light	4,220
Smackover, heavy	31,320
Stephens	870
Nevada	990
Lisbon	715
Champagnolle	2,920
Bradley	50
Urbana	1,550
Total Arkansas	46,245
Total previous week	46,660
Decrease	415
Total both states	84,900
Total previous week	85,550
Decrease	650

LOUISIANA-ARKANSAS PROVEN AREAS

NORTH LOUISIANA
BOSSIER PARISH

Company, farm and location—	Remarks:
H. I. Morgan's No. 13-A Kendrick, 660 ft. E, 330 ft. S, NW cor. SE SE, Sec. 22-19-11	Killing well with D.S. in hole.

CADDO PARISH—GREENWOOD

Calatex O. & G. Co.'s No. 1 Edgar, 1,460 ft. S, 1,900 ft. E, NW cor., Sec. 17-16-16	Temporarily abd.
Calatex O. & G. Co.'s No. 1 McAnn-Alfred, 1,310 ft. S, 970 ft. E, NW cor., Sec. 17-16-16	Location temp. abd.

CADDO PARISH—OIL CITY

Trio Corp.'s No. 1 Levee Board, 212 ft. S, 500 ft. E, NW cor., Sec. 17-20-15	1,220 ft. oil in hole 2,265 ft; W.O. S.R.

CADDO PARISH—PINE ISLAND

Haynes Bros.' No. 2 Spell, 956 ft. W, 300 ft. N, SE cor. SE, Sec. 15-21-15	S.D. 3962 ft.
J. T. McCormick's No. 1 C. B. Christian, 330 ft. S, 300 ft. W, NE cor. SW, Sec. 27-21-15	S.D. 1,335 ft.
Shreveport Oil Corp.'s No. 2-B Muslow, 1,000 ft. S, 300 ft. E, NW cor., Sec. 32-21-15	Drlg. plug 2,125 ft.
Simplex Oil Co.'s No. 1 Youree-Glassell, 500 ft. N and E, C, Sec. 13-20-15	Set 10-in. 150 ft; S.D.

MOREHOUSE PARISH

Bahan & Bahan's No. 4 Feasel, 900 ft. W, 300 ft. S, NE cor., Sec. 2-20-4	Location.

OUACHITA PARISH

Jordan Drlg. Co.'s No. 7 Cole, 265 ft. S, 1,459 ft. W, NE cor., Sec. 49, in Sec. 50-18-4	Location.
United Carbon Co.'s No. 6 Spade, 1,180 ft. S, 140 ft. E, NW cor., Sec. 27-19-4	Location.

RICHLAND PARISH

Hope Prod. Co.'s No. 3 Noble, 2,049 ft. S, 2,607 ft. E, NW cor., Sec. 1-15-5e	Set 9-in. csg. 909 ft; drlg. 1,945 ft.
Palmer Corp.'s No. 1 Clement, 2,980 ft. N, 1,320 ft. E, SW cor., Sec. 10-16-4	Arranging to test 2,400 ft.
Pelican Nat. Gas Co.'s No. 2 Chapman, 660 ft. N and W, SE cor. SW, Sec. 14-16-5e	Rigging up.
State Line O. & G. Co.'s No. 1-A Holdiness, 1,062 ft. E, 760 ft. N, SW cor., Sec. 10-16-6e	Derrick.
United Carbon Co.'s No. 2 Cooper, 660 ft. N, 3,551 ft. E, SW cor., Sec. 13-16-4	Changing location.

SABINE PARISH—ZWOLLE

W. M. Coates' No. 1 Williams, NE cor., Sec. 23-7-11	Began May 23; set 10-in. 85 ft; drlg. 1,000 ft.
Hawkins et al's No. 1 Moran, Sec. 1-7-11	400 ft. oil in hole 2,620 ft; W.O. S.R.

(Continued on Page 256)

WILDCAT OPERATIONS IN LOUISIANA-ARKANSAS

(Rotary operations unless otherwise designated)

NORTH LOUISIANA
BIENVILLE PARISH

Company, farm and location—	Remarks:
Ark.-La. P. L. Co.'s No. 1 Giddens, 560 ft. N, 660 ft. E, SW cor. NW SW, Sec. 14-16-10	Set 15½-in. 112 ft; drlg. 1,111 ft.

BOSSIER PARISH

Andrews & Davlin's No. 1 Nattin, 100 ft. N, 250 ft. W, C, Sec. 15-22-14	Resumed drlg. 2,950 ft.
Flint River Oil Co.'s No. 1 C. L. DeMoss, 200 ft. S and E, NW cor. SE NW, Sec. 22-22-13	Drlg. 2,657 ft.
Dr. W. N. Hankins' No. 1 Newell, 300 ft. S and W, NE cor., Sec. 12-19-11	Drlg. 720 ft.
D. L. Perkins' No. 1 Ardis & Co., 1,127 ft. N, 198 ft. E, SW cor., Sec. 13-16-11	Rigging up.
D. L. Perkins' No. 1 J. W. Glover et al, 560 ft. N and W, SE cor. NE, Sec. 22-15-11	Location.
Rombaugh et al's No. 1 Allison, SW SE, Sec. 10-19-13	S.D. 1,600 ft.

CADDO PARISH

Pelican Nat. Gas Co.'s No. 1 Cooper et al, 1,810 ft. E, 1,064 ft. S, NW cor., Sec. 29-18-14	Changing drill stem 2,958 ft.
United Gas Public Service Co.'s No. 1 M. K. Smith, 660 ft. S, 2,640 ft. W, NE cor., Sec. 33-23-16	Drlg. chalk 2,217 ft.

CALDWELL PARISH

Carter Bell's No. 1 Taylor, 150 ft. S, 150 ft. E, NW cor. SE, Sec. 17-14-4	Derrick.
Hudson et al's No. 1 Burton, Sec. 35-12-2e	S.D. 2,950 ft.

CATAHOULA PARISH

National Drlg. Co.'s No. 1 Marsh McMiller, 70 ft. N, 100 ft. W, C, Sec. 26-9-6	T.A. 3,097 ft.

CLAIBORNE PARISH

Leue Oil Co.'s No. 1 Kinder, 154 ft. N, 642 ft. E, SW cor. SE, Sec. 2-21-7	S.D. 1,550 ft.

CONCORDIA PARISH

United Gas Public Service Co.'s No. 1 Hughes, 660 ft. S, 45° 30" E, 660 ft. N 60° 30" E of NW cor., Sec. 49-8-10	D.S. test dry 1,483 ft; drlg. 1,740 ft.

DE SOTO PARISH

Dupree-Fountain's No. 1 J. M. Nabors, 250 ft. S, 250 ft. W, NE cor. NW, Sec. 5-12-11	Dry and abd. 2,425 ft.
Keatchie O. & G. Co.'s No. 1 Hallie Smith (was H. E. Welchert's), NE SE, Sec. 31-14-15	S.D. 2,350 ft.
C. D. Neff et al's No. 1 Ramsey, 1,000 ft. W, 400 ft. S, NE cor. SE, Sec. 33-13-16	Dry and abd. 3,081 ft.
Ben Merritt, tr.'s No. 1 Wallums, NE cor. SW SW, Sec. 29-12-12	Drlg. 2,385 ft.

(Continued on Page 256)

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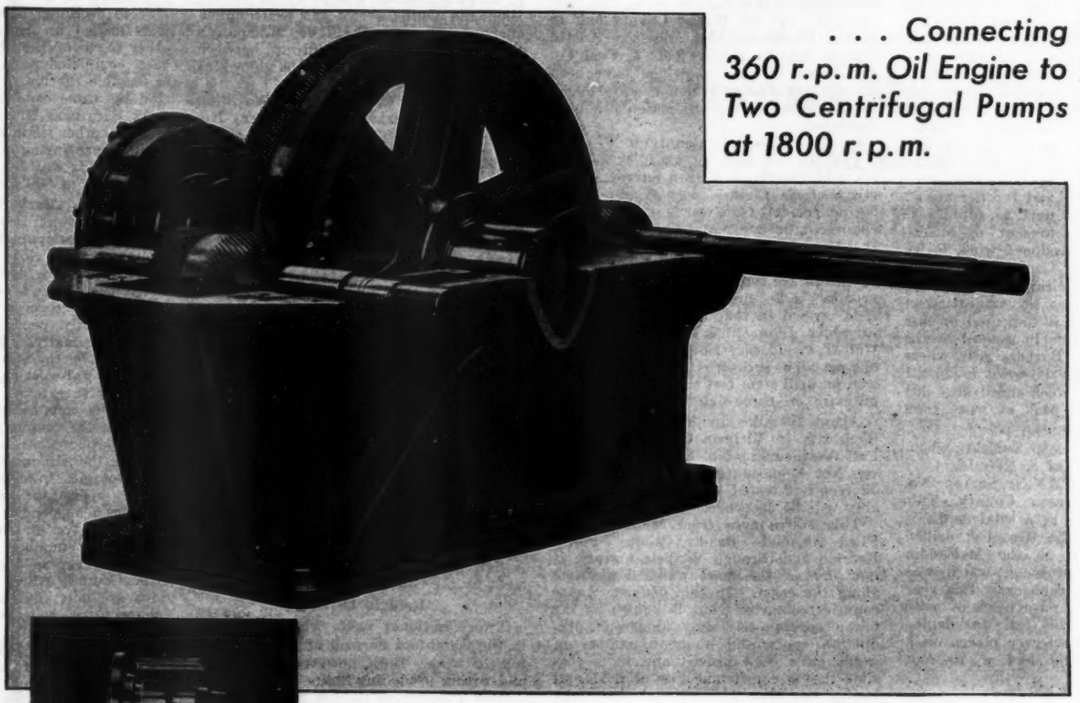

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Falk Flexible Couplings, because of their special construction, assure exceptional resiliency with great strength, positive lubrication, ease of installation, low upkeep cost and dependable operation. They are made in standard sizes from 1-5 H. P. to 18,800 H. P. at 100 R. P. M. and are carried in stock for immediate shipment.

FOR many years, men in all branches of industry have said "it pays to consult Falk first". Now men in the oil fields are proving the truth of that phrase.

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Simple . . . sturdy . . . vibrationless . . . built for continuous, day-in and day-out duty like all other Falk Gear Drives, this new Speed Increaser typifies the ability of Falk to render a service that always excels.

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SPEED REDUCERS **FALK**

Gulf Coast Operators Cut Production

Operations Show Curtailment in Line With Efforts to Limit Drilling to Tests Regarded Absolutely Necessary

By Neil Williams
Staff Correspondent, Gulf Coast Fields

HOUSTON, Tex., June 1.—Three deep wildcats of interest on the Gulf Coast were abandoned the past week. In addition general operations in this territory showed further curtailment in line with efforts to limit drilling to tests absolutely necessary. Comparatively few new tests were started up during the week and for the most part as rapidly as present operations are completed or abandoned work is being suspended. That Coastal production will be reduced to within the allowable of 140,000 bbls. before the expiration of the 30 days of grace is indicated in cuts which have been made in several of the larger fields, chiefly Barbers Hill, where the daily output now is down to 25,821 bbls. (daily average week ended May 30) as compared to the peak of more than 31,000 bbls. several weeks ago.

Chief among the deep wildcats abandoned was Humble Oil & Refining Co.'s No. 1 McFaddin, T.&N.O. Survey No. 234, southern Jefferson County. This test was quit as dry at a total depth of 7,663 feet. It was the first test drilled on what is known as the McFaddin Ranch Salt Dome prospect, which was checked with seismograph early this year following exploration on a block of more than 80,000 acres. This test was drilled with the largest set-up ever placed on a Gulf Coast well and had a 164-foot derrick.

Whether another test will be drilled any time soon has not been indicated. No showings of any kind were encountered in the test and no indication of a salt dome was given to bear out the geophysical findings, although that does not necessarily condemn the prospect. In view of the policy of this company to restrain operations in the Gulf Coast, it is probable that the rig will be stacked, making one less operation in this territory.

Big Hill Test Abandoned

Another deep wildcat in the same county also was abandoned, that being The Texas Company's No. 4 Pipkin, located on the southeast flank of the Big Hill Dome. Big Hill, which is one of the older domes on the Coast but so far unproductive commercially, is less than 8 miles to the west of Humble's new McFaddin prospect. The test was abandoned in heaving shale after having drilled to a total depth of 5,970 feet. It is the fifth drilled by this company, which started development there late in 1928.

Heavy gas showings have been encountered in nearly all these tests and several have had blowouts. Heaving shale, however, has proved an obstacle to successful completion in each and all have been abandoned. Developments have been sufficient to encourage this company to continue operations steadily with one rig running. In the early days of Big Hill some producing wells were completed but these proved short lived and for the most part no general development has been carried on.

San Felipe Dome

On the Austin County side of the San Felipe Dome, which straddles the Austin-Waller County line, Empire Gas & Fuel Co. has abandoned its No. 1 Kuntze at a total depth of 7,215 feet in shale. This is the deepest test ever drilled on this dome, the previous record having been only 4,825 feet. This is the ninth wildcat on the dome, which was geophysically discovered by Gulf Production Co. in 1927. Gulf drilled one test on top of the dome, drilling into cap rock around 3,250 feet and proving the dome, and then "farmed" out the Waller County half to Kirby Petroleum Co. and the Austin County side to Empire Gas & Fuel Co. A number of good showings have been encountered and several blowouts experienced but so far no production has been developed.

Victoria County

Late in the week, T. B. Slick estate's No. 1 McFaddin, J. Vairan Survey, southern Victoria County, was standing with casing cemented to test a gas sand encountered at 3,502-12 feet, as stated in the May 21 issue of The Oil and Gas Journal. The attention of numerous operators are centered on this test which promises a 3½-mile extension of the gas field opened in that area late last year, in which Lion Oil & Refining Co. and United Production Corp. have two producing high pressure wells. The Slick well on drill stem test showed 650 pounds pressure on three-eighths-inch choke.

About 10 miles up the coast from the Slick test in Victoria County, Simpson-Fell-Westheimer's No. 1, S.A.&M.G. Survey No. 4, encountered a sand at 3,847-52 feet but tested salt water, It probably will be deepened.

This entire area from the Kingsville Field through Saxet, White Point, Refugio and through Victoria County, is now one of the most watched districts along the coast. In this district, whose counties comprise what is known as the lower coastal territory, numerous production spots and a great number of sands have been proved and it is possible that a continuous line of fields, all having the same general conditions may be developed.

In southern Victoria County, The Texas Company made location during the week for its third wildcat, No. 3 McFaddin, located south 15° 6,200 feet west and north 75° 1,850 feet west of the northeast corner of the John M. Rine Survey. This location throws the test to the north and west of No. 2 McFaddin in the C. M. B. Boyd Survey, which blew in as a gas well early this year with bottom of hole at 2,025 feet. The well, which made considerable water, has been shut in since. It is approximately 4 miles to the west of Lion and United's two gas wells, previously mentioned. The Texas Company's first test was drilled midway between these two areas and was abandoned as dry at 6,684 feet.

Houston Oil Co. has started drilling on its No. 1 Conrad, T.&N.O. Survey No. 1, in the northern part of Victoria County. This is the first test on what is known as that company's Beck block and also will prove an interesting test.

Clear Lake

H. R. Cullen's No. 1 Lockwood & Nash (formerly designated as No. 1 Lockwood) which last week opened a new field on the Clear Lake geophysical prospect, eastern Fort Bend County, has been pinched to 3 bbls. an hour on an eighth-inch choke. The flow is being restricted to this pending the completion of a 5½-mile line being laid to the well by Gulf Pipe Line Co., present storage facilities being limited. The well was completed flowing an estimated 350 bbls. daily of good Grade A oil.

Following completion of the well, location has been made for the second test, No. 1 Lockwood, 300 feet out of the southwest corner of the 383-ac. tract, John Rabb Survey. This is approximately 2,000 feet southwest of the discovery well. A rig is up and drilling started. A half interest is owned in this development by the Gulf Production Co.

Refugio District

Two additional wells were completed in the 6,400-foot horizon at Refugio during the week. Both, however, were small and within producing limits. These were United Production Corp.'s No. 6 Power, center of Block 83 of the townsite, flowing 200 bbls., 1,850 pounds pressure, with 18 feet of screen at 6,458 feet, and Moody-Seagraves Producing Co.'s No. 8 O'Connor, 26 bbls. per hour, sand 6,423-48 feet.

Of some interest is the location by United Production Corp. for No. 5 Holmes Heard, 660 feet from the north line and 2,375 feet from the west line of Block 8. This test is on the extreme north end of the Refugio district. It is near some old gas wells but is approximately 1,500 feet north of the nearest oil production. Due to declining pressures, a number of tests drilled in original gas territory in other parts of the Refugio district have been completed as oil producers and it is possible the No. 5 Holmes Heard may find the same condition.

At Saratoga, Rio Bravo Oil Co. completed another shallow producer as a part of its repressuring project being carried on there. It was No. 116-A Cotton, good for 70 bbls. at 500 feet.

Barbers Hill

Operations at Barbers Hill are continuing at comparatively low ebb. Although at the close of the week, four deep tests were testing or due to be tested, there have been no important completions for several weeks, and consequently daily production has been declining gradually. With the ending of line fights on the west flank of the dome, where several weeks ago competitive drilling plays threatened the Gulf Coast situation, few new locations are being made and with the completion of present operations development is slowing up.

With the elimination of Barbers Hill and Refugio from active drilling programs, operations in all fields either have been suspended entirely or are being carried on in routine fashion with a minimum number of rigs. The only active wildcat spot seems to be in Victoria County, where so far the indications are only for gas and in which development is being carried on in large blocks.

Lockport Price Change

A reduction of from 5 to 16 cents, depending on grade and gravity, was posted by the Vacuum Oil Co. in the Lockport Field, Calcasieu Parish, Louisiana, effective May 27. The prevailing coastal prices formerly were applied to the field. Grade B oil, which under the coastal gravity schedule ranged from 60 cents for crude below 25 gravity to 81 cents for 35 gravity and above, was posted at 55 cents. Grade A oil was reduced 10 cents to 60 cents. No other fields are affected.

Lockport at present has a production of better than 7,300 bbls. daily. Except for the new west extension district where Union Sulphur Co. and Yount Lee Oil Co. has some production, Vacuum Oil Co. is the sole operator and producer, Gulf Refining Co. holding a third interest with the Vacuum. This company has been handling its own production, marketing it on the East Coast. Until the past month it also has been buying the third interest of the Gulf Refining Co., but now the latter company is taking its third in oil. Union Sulphur Co. and Yount Lee Oil Co. market their own oil.

The action of Vacuum Oil Co. is a reflection of the cheap oil in East Texas which can be marketed at considerably lower prices than coastal light gravity oil and which is of greater value from a gasoline standpoint than the coastal crude of corresponding gravity. The situation is explained in a statement issued by the Vacuum Oil Co. in connection with the price cut. The statement follows:

"Effective at 7 a.m. Wednesday, May 27, 1931, we will post the schedule of prices attached for crude oil in the Lockport Field in Calcasieu Parish, Louisiana. We find ourselves unable to pay the prices prevailing for the grades of crude produced in that field because we are unable to market the oil at the prices made necessary by present prices. The graduated gravity scale for Grade B will be abolished because the high gravity crude, valuable for its gasoline content

(Continued on Page 264)

GULF COAST FIELDS AND WILDCATS

Week Ended May 30
All Rotary

BARBERS HILL—CHAMBERS COUNTY

Gulf Production Co.'s No. 4 Wilburn (D.D.), Henry Griffith League, 1,400 ft. W line and 50 ft. S line of lease	Pulling screen and liner to deepen 5,239 ft.
Humphreys Corp.'s No. 5 E. H. Winfree, W. D. Smith Sur., 854 ft. from S line and 50 ft. from W line	Sand showing oil 5,354 ft.; cem. 7-in. casing.
Humphreys Corp.'s No. 6 E. H. Winfree, W. D. Smith Sur., 50 ft. from N line and 50 ft. from W line of tract	Cap rock 3,741 ft.; reaming to straighten hole.
Humphreys Corp.'s No. 1 Anna Davis, Henry Griffith League, 475 ft. from N line and 71 ft. from E line of Strip 6	Drlg. sand and shale showing oil 5,254 ft.
Humphreys Corp.'s No. 2 T. S. Fitzgerald, Henry Griffith League, 300 ft. from N line, 65 ft. from E line of tract	Shale 3,456 ft.; cem. casing.
Humphreys Corp.'s No. 1 Fitzgerald-Meadows, Henry Griffith League, 50 ft. S and 100 ft. E of NW cor. of tract	Drlg. sandy shale 1,147 ft.
Mills Bennett Prod. Co.'s No. 1 Gulf-Fisher (workover), William Bloodgood Sur., 50 ft. from SW line and 250 ft. from SE line tract	Total dpth 5,344 ft.; plugged to 4,635 ft.; milled out and sidetracking in lime 5,028 ft.
Mills Bennett Prod. Co.'s No. 4 Gulf-Fisher, William Bloodgood Sur., 300 ft. from W line, 80 ft. from N line tract	Losing returns 1,318 ft.
Rio Bravo Oil Co.'s No. 2 Fisher, west flank	Sand and shale showing oil 5,272 ft.; cem. casing.
Sinclair O'l & Gas Co.'s No. 2 Smith, W. D. Smith Sur., 50 ft. out of S cor. of tract	Lime rock 3,708 ft.; drill stem stuck.
Sun Oil Co.'s No. 2 Smith, W. D. Smith Sur., 75 ft. from W line, 50 ft. from N line of tract	Drlg. rock 4,267 ft.
Sun Oil Co.'s No. 3 Smith, W. D. Smith Sur., 50 ft. from S line, east offset Yount Lee Oil Co.'s No. 3 Winfree	Drlg. rock 3,904 ft.

(Continued on Page 260)

You are Sure to Increase Profits by Reducing Waste

It is an absolute certainty that if you eliminate waste of oil between the well and the pipe line your income will be increased by the market value of the oil formerly wasted.

You Can Eliminate Serious Breathing Losses by the Use of Maloney VAPOR-PRESSURE Tanks

These tanks are equipped with combination valves set at 16 oz. pressure and 2 oz. vacuum. They are made of not less than 12-gauge rust-resistant Keystone Copper Steel, with heavy 2-inch angle ties and reinforcements and high grade aluminum paint. This construction restricts the movement of vapors and maintains the well gravity of the oil.

On many leases Maloney *Vapor-Pressure* Tanks will save enough oil to pay for the tanks in a short time; and from then on the increased income is pure velvet.

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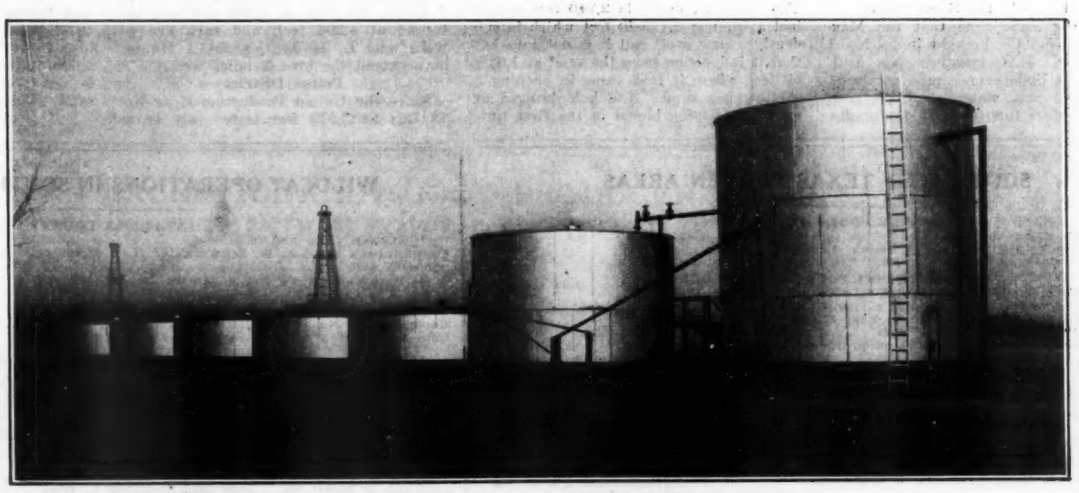

One 1,500-Bbl., one 1,000-Bbl. and five 500-Bbl. Maloneys at Valley Center, Kansas.

MALONEY

New Gas Sand Opened in Laredo Area

Magnolia's No. 1 Benavides at Extreme South End of Cole and O'Hern-Seacord Pools Starts Off at 25,000,000 Feet

By B. D. Stevenson
Staff Correspondent, Southwest Texas Fields

SAN ANTONIO, Tex., June 1.—Magnolia Petroleum Co.'s No. 1 Benavides in the northwest corner of Survey 172 at the extreme south end of the Cole and O'Hern-Seacord Pools at 2,455-65 feet is a 25,000,000-foot gas well and opens an entirely new sand. It showed 1,100 pounds pressure. Production in the Cole Pool is at around 1,700 to 1,800 feet. A half mile northwest of it there is production at 1,750 feet and one well drilled by O'Hern-Seacord got production at 2,733 feet. Five miles northwest or thereabouts there is production in a sand at around 2,350 feet. The production half a mile northwest is the nearest and it is in wells on the O'Hern-Seacord property which was later purchased by the Magnolia from Wilkins Seacord.

This new Magnolia Petroleum Co.'s No. 1 Benavides has wonderful possibilities. It was rather unexpected at that depth. Contours worked out by geologists in that field show a nosing to the southeast and there is a bare possibility that the producer at 2,733 feet, a half mile northwest, is producing from the same sand as this No. 1 Benavides at 2,455-65 feet. If so, there is an enormous anticline lying to the east of the Cole Field. Some think that the contours as worked out on but a few wells in deeper sands would indicate the presence of the anticline.

May Pick Up the Same Sand

About the same time that the Magnolia Petroleum Co. brought in its No. 1 Benavides S. J. Carpenter's No. 1 J. Benavides, a little over a mile northeast of it, tested salt water at 1,660 feet. The week before this test had produced a core that looked good and had produced enough oil to fill a bottle for a sample. However, it is in fairly good position to pick up the same sand that the Magnolia has picked up by drilling deeper.

Besides the Magnolia well there were three other completions in the Laredo district last week and all of them in the Jennings-Muckelroy Pool in northeastern Zapata County, two of them in the shallow sand and one in the deep. Allied Oil & Gas Co.'s No. 15 Guiterrez in sand at 1,483-85 feet is a 150-bbl. well in Share 4 of the Comitas grant. It is between the two ends of the field with no producer near it. O. W. Killam's No. 8 Bustamente in Share 5, southwest of it, is a 50-bbl. well at 1,253 feet, and Trevino Oil Corp. in Block 15 of Survey 412 at the extreme north end of the field is a 40-bbl. well at 1,231 feet with casing set at 1,207 feet.

Otherwise the picture in the Laredo district was not much changed the past week. Humble Oil & Refining Co.'s No. 50 Kohler in Duval County, which got salt water at 6,020-87 feet after elaborate preparations had been made expecting to encounter heavy gas, got a dry sand at 6,216-27 feet and is last reported drilling at 6,230 feet. It set 9⅝-inch casing at 6,020 feet and is already the deepest hole that has been drilled in the Laredo district and is interesting and important on account of the log whether it gets production or not.

Corpus Christi District

In the Corpus Christi district the Houston Oil Co.'s No. 1 Lawrence in the Saxet Field in Neuces County reported last week as having blowed the tools out of the hole and running wild is still wild. The corrected depth is 2,740 feet and it had a sand at 2,725-40 feet which is evidently a new sand, but it is not sure but that it is blowing from the sand at 1,625-69 feet where it first came in opening a shallow gas sand. The hole bridged at one time, having blown in the first time when the tools were out of the hole. Tools were sent in and the bridge knocked out and it blew in again, that time blowing the tools out of the hole and destroying the derrick. Later last week it was capped after being closed in for a time blew the fittings off and is again wild.

Developments in that field the past week include the Gulf Coast Oil Co.'s No. 1 Harrell, a mile north of the wild gasser and with a sand at 4,087-95 feet. It has set casing and is about ready to drill in with a showing of oil. L. L. Smith's No. 1 Hunter, between this well on the north and the wild gasser on the south, cored a sand at 4,088 feet but is now drilling at 4,293 feet, which is right at the depth where it should pick up the 4,300-foot pay producing in two wells 2 miles to the northeast. Houston Oil Co.'s No. 2 Rand Morgan is located about 1,750 feet east of the wild gasser and was a small well at 4,095 feet. It is now drilling deeper and is down to 4,597 feet but has not found anything more. In the study of the field it should be taken into consideration that the Gulf Coast Oil Co.'s No. 1 Harrell on the north testing a showing at 4,095 feet is approximately 6,500 feet northwest of the Houston Oil Co.'s No. 2 Rand Morgan which has started to drill deeper from 4,095 feet and L. L. Smith's No. 1 Hunter is on a line with them and about midway between them.

Saxet Oil Co.'s No. 8 Dunn in the center of the older Saxet area tested 5 fourbles of oil on drill stem test at 4,277 feet and has set casing and is about ready to drill in. There are only two other tests in the whole area in that horizon, the Saxet Oil Co.'s Nos. 6 and 7 Dunn, the first at 4,300 feet and the second at 4,296 feet, and each are oil wells, and L. L. Smith's No. 1 Hunter may extend the area 2 miles west.

Pettus District

Since the United Production Co.'s No. 38 Ray at 3,979 feet tested salt water and stopped the extension of the field to the east at that particular place the interest centers in the company's No. 37 Ray, a full mile southeast. There is a small well at 4,060 feet located 7,500 feet east of the No. 38 Ray salt water well and 4,500 feet northeast of the No. 37 Ray now drilling and the No. 11 Ray, 1,500 feet south of the No. 37, blew out with gas at 3,815 feet and was lost, so there seems a chance for the No. 37 Ray in spite of the fact that the No. 38 Ray made salt water in a sand where it should have made oil.

Last week Gulf Coast Oil Co.'s No. 2 McKinney was completed as a gasser for about 25,000,000 feet in sand at 3,715-30 feet and close to two other wells, one a gas well and the other an oil well at 3,686 feet. It has been shut in and was not gauged but the pressure was 1,100 pounds.

J. M. Davis, approximately a mile southeast of nearest production in the Pettus Townsite, has got started and is down around 2,000 feet and it and the United Production Co.'s No. 37 Ray at this time are the only active tests in the Pettus area and there are only two other tests listed, the two Mauldin tests, which have not yet been completed though they each have showings of oil.

V. F. Neuhaus is getting ready to start into the No. 1 J. E. Pettus, drilled in Goliad County early in 1929 by the Southern Crude Oil Purchasing Co. to 3,853 feet and abandoned dry. The interesting feature of the test is that it is about 15 miles northeast of the Pettus Field in Bee County and about 3 miles from the northwest line of the county and laying about in the general structural trend with the Pettus Field. The idea is to deepen it a little to around 4,000 or possibly 4,500 feet and see if it is not possible to pick up the Pettus sand. The test is about 5 miles south of

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SOUTHWEST TEXAS PROVEN AREAS

COOKSEY POOL—BEXAR COUNTY

Company, farm and location— Remarks:
Pena Oil Co.-Cun Oil Co.'s No. 1 Pollok, 1,100 ft. SW of No. 1 Cooksey in John W. Ralli Sur. ..... Set csg. 1,382 ft.

DOBROWOLSKI POOL—BEXAR COUNTY

Gatlin Oil Co.'s No. 7 I. A. Beck, 150 ft. SW line, 1,351 ft. SE line of tract, Montes Sur. ..... Rigging up.
Patton & Yocum's No. 1 T. Strunk, 1,351 ft. from SE line, 150 ft. from NE line of tract ..... T. D. 727 ft.; set csg.
W. S. Rogers et al's No. 1 L. Donnop, Juan Montes Sur. ..... T. D. 550 ft.; drlg.

BRUNER POOL—CALDWELL COUNTY

Joe Bruner's No. 1 Malone, A. Floyd Sur. ..... T. D. 210 ft.; drlg.

EDDINGTON POOL—FALLS COUNTY

Eddington et al's No. 3 Llewellyn, George Allen Sur. .. T. D. 1,070 ft.; fishing.

DARST CREEK FIELD—GUADALUPE COUNTY

Magnolia Pet. Co.'s No. 8 M. T. Klein, 300 ft. SE of No. 1 ..... T. D. 1,600 ft.; drlg.

CHAPMAN POOL—WILLIAMSON COUNTY

Chapman et al's No. 2 Lawrence, S. Miller Sur. ..... T. D. 1,916 ft.; set 6⅝-in. csg.; waiting on cement.
E. R. Ertel et al's No. 10 Abbott, 700 ft. from W line, 450 ft. from S line of farm, S. Miller Sur. ..... T. D. 1,947 ft.; comp. 35 bbls.
E. R. Ertel et al's No. 11 Abbott, 450 ft. from N line, 750 ft. from W line of farm, S. Miller Sur. ..... T. D. 1,932 ft.; comp. 950 bbls.
Vitex Oil Co.'s No. 8 Kilgore, Simon Miller Sur. ..... T. D. 1,736 ft.; waiting on cement.

PETTUS AREA—BEE COUNTY

J. M. Davis et al's No. 1 Ray, 330 ft. from N and E lines of John W. Williamson Sur. ..... T. D. 1,200 ft.; drlg.
J. L. Mauldin's No. 1 fee, 1,300 ft. N of S line, 150 ft. E of Medio Creek, Kerr Sur. ..... T. D. 3,862 ft.; standing.
Gulf Coast Oil Co.'s No. 2 McKinney, 2,400 ft. to E and 150 ft. to S line of tract ..... T. D. 2,730 ft.; comp. est. 20,000,000 ft. gas.
United Prod. Co.'s No. 37 Ray, 3,300 ft. from SW line, 996 ft. from SE line of Willis A. Moore Sur. ..... T. D. 2,431 ft.; drlg.
United Prod. Co.'s No. 38 Ray, 900 ft. E, 10° S of No. 35 Ray ..... T. D. 3,979 ft.; abnd. dry.

RANDADO POOL—JIM HOGG COUNTY

Randado Oil Corp.'s No. 35 Palacios, 150 ft. to S line, 450 ft. to E line, Blk. 2, Sur. 291 ..... T. D. 1,301 ft.; waiting on cement.

CARTWRIGHT POOL—LIVE OAK COUNTY

Houston Oil Co.'s No. 23 Cartwright, 691 ft. N, 30° E of No. 11 ..... T. D. 1,297 ft.; drlg.

CHITTIM POOL—MAVERICK COUNTY

Texas Gas Utilities' No. 8 Chittim, 24 ft. S of No. 7 Chittim ..... T. D. 1,710 ft.; drlg.

(Continued on Page 258)

WILDCAT OPERATIONS IN SOUTHWEST TEXAS

ATASCOSA COUNTY

Company, farm and location— Remarks:
Tom Draper's No. 1 A. W. Schwars, 185 ft. E of center of W line ..... T. D. 728 ft.; abnd.
Glen Mathis, trustee's No. 1 Martin in J. Arranoga ..... T. D. 500 ft.; drlg.

BLANCO COUNTY

Hardy-Sitton's No. 1 McMillan ..... T. D. 696 ft.; drlg.
Liles-Adams et al's No. 1 Stanford, 150 ft. to S line, 1,120 ft. to E line of James Stanford's No. 155 ..... T. D. 970 ft.; renewed leases; will drill deeper.
McCleary et al's No. 1 Schenling, 900 ft. to SE line, 600 ft. to S line of J. A. Rouse No. 118 Sur., 4 miles SW from Blanco City ..... T. D. 574 ft.; shut down.
J. R. Meek's No. 1 Walker, 360 rds. from W line, 432 rds. from S line of 275-ac. tract in Sur. No. 33 ..... T. D. 1,047 ft.; standing.
C. Rosenfield's No. 1 Hohenberger, 800 ft. to W line, 1,360 ft. to N line, Sur. No. 94 ..... T. D. 712 ft.; shut down.

BASTROP COUNTY

Schimmel & Batts' No. 1 J. E. Ferguson, 160 ft. from NW line, 1,600 ft. from NE line of tract in J. Doyle Sur. ..... Location.
Smith & Barnes' No. 1 Marberger, 450 ft. W line, 1,360 ft. S line of tract in King & Millet Sur. ..... T. D. 211 ft.; drlg.

BELL COUNTY

Hartman et al's No. 1 M. E. Reed, Nancy Roberts Sur. .. T. D. 907 ft.; showing oil; shut down.
Mildon Oil Co.'s No. 1 J. K. Edds, Maxiano Moreno Sur... T. D. 519 ft.; drlg. shale.
C. O. Alford's No. 1 A. L. Keifer, 150 ft. from S and W lines of tract in Woodford Sur. ..... Location.
Vilas Oil Co.'s No. 1 B. F. Whittington, 9 miles E of Holland ..... Moving in rig.

BROOKS COUNTY

O. C. Woods' No. 1 J. G. Ramos, 959 ft. to E line, 788 ft. to S line of Tract 10, Blk. 3, Amos Dinn Subd., La Lestena grant ..... T. D. 200 ft.; drlg.
Ike Howeth's No. 1 Singer, 400 ft. E of Humble's No. 1 Singer ..... T. D. 1,140 ft.; drlg.
The Texas Company's No. 1 Allen, San Antonita grant .. T. D. 1,410 ft.; drlg

BEE COUNTY

Alexander et al's No. 1 McFall, 3 miles S Skidmore .... T. D. 1,206 ft.; shut down.
Grebin & Woods' No. 1 Riggs, 4,800 ft. to E line, 200 ft. to N line of James Nowland Sur., 6 miles W of Skidmore ..... Rigging up.
Mauldin et al's No. 1 Kimball, 360 ft. S Grayburg's No. 1-A Kimball, S. Winship Sur. ..... T. D. 3,544 ft.; standing.

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San Juan County Activity Increases

Renewal of Interest in Greasewood Dome, Colorado, Area. Osage Field, Wyoming, Extended. New Showing in Well Near Denver

By Tolbert R. Ingram
Staff Correspondent, Rocky Mountain Area

DENVER, Colo., June 1.—San Juan County, northeastern New Mexico, is showing an increase in activity and six wells are making progress. The Southern Union Gas Co. interests completed a 3,200,000-foot gas well in the Kutz Canon district. In Lea County, Leonard & Levers have a show of oil and gas in their No. 1 Justis, northeast side of the Jal Dome. The Buffalo Creek test in De Baca County, which has been idle two years, is preparing to resume. Helium possibilities in Harding County caused government inspectors to visit the Kumbaca Oil & Gas Co.'s well in the Bueyeros district. A 6,000-foot test to the Pennsylvanian in Rio Arriba County may be drilled this summer.

One well drilling and two more to spud by July 1 on the Greasewood Dome in Weld County again is attracting attention to northeastern Colorado. The Indian Territory Illuminating Oil Co. will complete its Morgan County test with rotary tools. The MacDeb well near Denver again is showing a little oil. Fred C. Haller's No. 2-A Carr in Montezuma County, found water in the Dakota. A Pennsylvanian test may be drilled on the Badito-Alamo Dome in Huerfano County. The California Co.'s Rangely Dome test cemented 28-inch conductor pipe at 30 feet in what promises to be a very important wildcat.

In Wyoming, the Osage Field was extended 3,000 feet to the southwest in Hugh Updike's No. 1, which is making 100 bbls. natural without being shot. The Producers & Refiners Corp. has about completed testing all formations down to the bottom of the Sundance on the Big Sand Draw Dome. The Mountain Fuel Supply Co.'s show of oil in the Baxter Basin district in its No. 1 Cappers proved to be unimportant when tested and hole may be abandoned.

Four wells to supply gas for Helena, Butte, Anaconda and other Montana towns from the Cut Bank Field, began spudding.

Utah reported progress in only two wells and Arizona has several tests under way.

NEW MEXICO

Lea County

Leonard & Levers' No. 1 Justis, C SE NE, Section 19-25-37, on the northeastern side of the Jal structure and in semi-wildcat territory, is tied up with a fishing job at a total depth of 2,758 feet after encountering a flow of gas that blew the bit up the hole. It is bottomed in sand and lime. There was a show of oil at 2,705-13 feet followed by gas at 2,743-48 feet, the flow being estimated at 1,000,000 feet. An increase in gas took place at 2,755 feet, the aggregate being estimated at 3,000,000 feet. The location is two-thirds of a mile east of the Continental Oil Co.'s No. 1 Sholes, completed as a gas well at 3,030 feet in 1929. This is the only well drilling in the Jal area.

Midwest Refining Co.'s No. 26 Capps, C SE SW, Section 3-19-38, the only well drilling in the Hobbs Pool, an offset on the north to the company's No. 11 Thorpe, is drilling at 4,000 feet in lime. It had 250,000 feet of gas at 3,755 feet, which blew the tools up the hole. At 3,775-85 feet it had some water, about 8 bailersfull per hour. This decreased, however, to one bailerfull per hour.

Culberson & Conrad's No. 1 State, C NE, Section 22-18-34, in the Caprock area, is drilling at 1,510 feet in the red beds.

Eddy County

J. O. Hammond & Son's No. 1 Gillette, C NW NW, Section 34-18-26, is drilling at 1,040 feet in brown shale and lime. This is an old well being deepened from 775 feet. It had a show of black oil at 828-33 feet and a small show of gas at 885-95 feet. Oil Well Drilling Co.'s No. 1 Baker, SE NE NE, Section 21-21-26, Carlsbad district, is bottomed at 969 feet in lime and has reamed hole to bottom. It will lower 6⅝-inch for a formation shutoff.

Otero County

Pasotero Petroleum Corp.'s No. 1 Evans, NW cor. SW, Section 22-24-12e, Pasotero structure, spudded on May 21 and will carry 10-inch to the top of the Pennsylvanian which is expected between 1,000 and 1,500 feet.

Chaves County

Warman Oil Trust's No. 1 Seibert, NE, Section 27-13-24, Blackdom district, was drilled to 2,686 feet and then plugged back with rock to 2,050 feet and shot with 20 quarts at 2,039-50 feet. The shot failed to bring in any production and the well was shut down.

De Baca County

Pittsburg Oil Co.'s No. 1 McAdoo, SW cor. NE, Section 16-1s-27, Buffalo Creek, started four years ago by the Navajo Oil Co. and subsequently taken over by the Pittsburg company, is reported preparing to resume. It was temporarily abandoned in June, 1929, at a total depth of 4,508 feet. Repairs are being made on the rig and 5,000 feet of 6¼-inch seamless casing is reported to have been ordered. Matador Oil Co.'s No. 1 Wood, NE SW SW, Section 6-4n-20, Salada Creek, is drilling at 3,105 feet in red shale.

Harding County

Kumbaca Oil & Gas Co.'s No. 1 Kerline, NW cor. SE, Section 34-21-30, Bueyeros district, has shut in the second flow of gas encountered at 820-25 feet, and is expected to resume drilling in about 10 days. C. C. Anderson and William Deaton, of the United States Bureau of Mines staff at Amarillo, and P. L. Ports, of the Department of Commerce at Washington, were reported to have inspected the well the past week, presumably to look into the possibilities of the gas having a helium content. The first gas, estimated at 500,000 to 1,000,000 feet, was encountered several weeks ago at 285-87 feet in a red sand. It was mostly carbon dioxide. The second flow at 825 feet was larger and was estimated at 3,000,000 feet. Tests are said to have shown an average content of 95 per cent carbon dioxide, the remainder of the content not being determined. Samples were taken to the government laboratory at Amarillo for analysis. Dr. J. T. Unerlt, of Milwaukee, head of the syndicate drilling the well, also was a visitor. In this same general district, only in Mora County, the Fulton Petroleum Co. is drilling for carbon dioxide gas to be used in manufacturing dry ice in its No. 1 Santa Fe-Dioice Co., NE cor., Section 14-19-21, which at last reports was down 860 feet. Several years ago Arkansas Gas & Fuel Co. drilled in the SE cor., Section 11-19-21, and abandoned the hole in granite, which was topped at 2,150 feet. At 1,425 feet it had a flow of noninflammable gas estimated at 20,000,000 feet a day, which tested 97.2 per cent carbon dioxide.

Guadalupe County

New Mexico Producing & Refining Co.'s No. 1 McMullin, SW cor., Section 24-5n-16, Mesa Leon district, spudded to 86 feet when it struck a cavity and the hole caved in. After cleaning out, pipe will be run. This well is carried in some reports as the Los Angeles-Hollywood Syndicate, and in others as the Bellview Oil Syndicate. These two concerns own the company which was incorporated recently to take over the operation.

San Miguel County

Pioneer Oil Co.'s No. 1 Farmer, SE cor. NW, Section 14-15-16, Montezuma district, is preparing to deepen from 2,340 feet, where it shut down last fall, to 3,200 feet. Contract has been let to C. S. Ringle.

Rio Arriba County

California interests are reported preparing to drill a 6,000-foot test with rotary and cable tools on the El Vardo structure in Rio Arriba County, 3 miles from the El Vardo Dam, on the Tierra Amarilla grant, about 35 miles south and a little west of Chama. Several months ago the Standard Oil Co. of Colorado reported it had secured 21,500 acres on the structure, which consists of two domes, one with 500 feet closure and the other with 600 feet of closure. Dean E. Winchester, of Denver, was reported to have mapped the structure, on which the Dakota is eroded.

Governador Dome Oil Co.'s No. 1, SE, Section 15-29-7w, Governardo district, is reported drilling at 880 feet and carrying the 8¼-inch.

San Juan County

Activity in the northwestern part of the State has shown considerable increase recently and San Juan County reports more wells making progress than any other county in the State. Murchison Oil Co.'s No. 6 Garland, SE NW SE, Section 34-29-11, in the Kutz Canon district, where Southern Union Gas Co. is building up a reserve for its gas system to Santa Fe, Las Vegas and Albuquerque, was completed at 1,794 feet with a flow of 3,200,000 feet. This well was drilled to the top of the sand with rotary tools last fall and shut down until recently. The same interests are drilling No. 2 Summitt in this district, which is bottomed at 1,719 feet and standardizing to drill in. Continental Oil Co.'s No. 24, SW cor. NW, Section 1-29-19, Rattlesnake Dome, delayed at 4,730 feet for several months with a stuck drill pipe, is working with pipe at 3,917 feet. R. C. Oswell's No. 2, NW, Section 34-30-11w, near Aztec, had a show of gas, estimated at less than 1,000,000 feet, at 375 feet. This was unexpected as the hole is still 1,000 feet above the objective. Rio Grande Development Co.'s No. 2 Lanier, SE cor. NW, Section 9-29-11, Bloomfield district, is drilling at 1,525 feet. Reserve Oil Co.'s No. 3, NW SE SE, Section 36-22-14w, Stoney Butte structure, is drilling at 750 feet after making a water shutoff with the 6⅝-inch. It is close to a location drilled by Midwest Refining Co. several years ago which showed for 30 bbls. of oil at 840-70 feet. H. L. Williams' No. 1 Stallings, NW SW, Section 17-25-15w, Rio Chaco district, is spudding with the Point Lookout sand at 1,800 feet as the first objective. It started in an 18-inch hole with standard equipment.

McKinley County

Johnsonwood Oil Corp.'s No. 1, SW, Section 12-15-10w, Walker Dome, which was reported a location three months ago, is moving in rig.

COLORADO

Weld County

The inauguration of drilling operations in the Greasewood district in Weld County, northeastern Colorado, where Platte Valley Petroleum Co. brought in the discovery well last October, is renewing interest in that area and a number of scouts from the Mid-Continent Field are putting in their appearance. The bringing in of the Platte Valley well was followed by a big leasing campaign in which a number of major companies blocked up acreage not only on the Greasewood structure, but in many other areas. Following this campaign, in the absence of any drilling, there was a letup in leasing and prices dropped. Desirable acreage held at high figures at that time can now be

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EXCEPTIONALLY GOOD PRODUCER FOUND IN SOUTH TURNER VALLEY

By Victor Lauriston
Staff Correspondent, Canadian Fields

CHATHAM, Ontario, May 30.—In the extreme south end of Turner Valley, Merland Oil Co.'s No. 1, Section 27-18-2w5, drilled by Imperial Oil, Ltd., looks like an exceptionally big producer. It got production 554 feet in the lime at 5,543 feet with a measured wet gas flow of 25,000,000 feet and estimated crude naphtha recovery between 500 and 600 bbls. Later it froze or bridged off but came back into production just as diamond drill tools were being brought in to clean out the hole. Owing to intermittent freezing, a definite production test has been impossible and tools were being run.

Merland's No. 1 is the southernmost test in the Turner Valley to get production in the deep lime horizon. It was located for Merland Oil Co. two years ago by Russell V. Johnson. The company carried the test to the Dalhousie sand and got a flow of wet gas, yielding crude naphtha, the first naphtha encountered above the lime horizon. The flow started at 200,000,000 feet but speedily pinched out. Later the test encountered drilling difficulties and stood idle for many months, until Imperial Oil, Ltd., undertook to complete it. Operations were resumed in January at 4,878 feet. There is some uncertainty whether the Merland test marks a southerly extension of the proven Turner Valley Field or is on a new structure, though Russell V. Johnson, who located the test, held the former view.

The strike is likely to be followed by some new drilling in the far south, if production holds up to early indications. Imperial Oil, Ltd., has already started work on Sterling Pacific Oil Co.'s No. 2 in Section 33-18-2w5, between the Merland well and the proven area further north. Just west of Merland's No. 1, Freehold Oil Corp.'s No. 4 was located some months ago in LSD 9, Section 28-18-2w5, on acreage of the Mar-Jon syndicate of Vancouver. Livingston Syndicate's No. 1, N half LSD 5, Section 34-18-2w5, has been standing cemented at a reported depth of 1,500 feet. Rand Petroleums' No. 1 was located a couple of years ago in LSD 5, Section 34-18-2w5, but has done no work yet, and other old and undeveloped locations in this area include Sunburst Oils' No. 1, Section 28-

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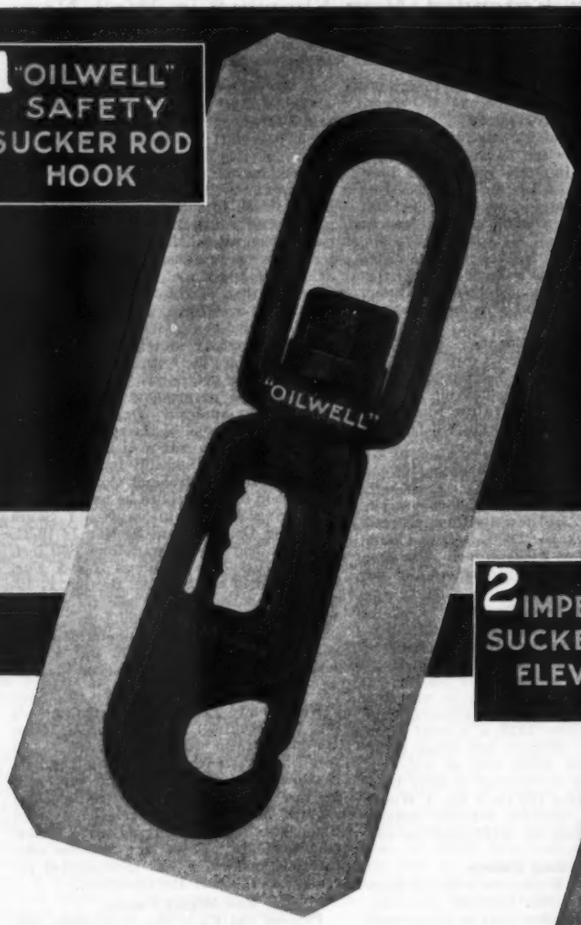

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New Curtailment Program for California

State's Production to Be Reduced to 427,500 Bbls. Daily Exclusive of Kettleman Hills, Which Is Allowed 60,000 Bbls.

By L. P. Stockman
Staff Correspondent, California Fields

LOS ANGELES, Calif., June 1.—Reduce crude oil production in California to economic requirements and an outlet will be provided at better prices for every barrel brought under curtailment. This in substance is what major companies told independent producers at a general open meeting held in Los Angeles May 27. Of course nothing was said about increasing the price of crude and refined oils, but this is synonymous with stabilization, so specific reference was not necessary. A new curtailment program, contemplating a further substantial reduction in state production, was ratified by the general committee and subsequently concurred in by the Oil Producers Sales Agency, to become effective Monday, June 1.

It is proposed to reduce oil production in California to 427,500 bbls. per day exclusive of Kettleman Hills, which will be permitted to produce up to 60,000 bbls. daily. This gives the State an allowable daily production of 487,500 bbls. from June 1, 1931, to January 1, 1932, unless California's compulsory curtailment law becomes effective sooner. Governo Rolph was expected to sign this recently enacted bill, in which event it will become a law around the first of August. It will require an additional month or six weeks to perfect the mechanics of operation, however, with the result that it may be late in the year before maximum enforcement is effected. The renewed attempt to effect a more stringent curtailment is predicated on the necessity of reducing crude oil production to requirements during the interim.

TRIAL SCHEDULE OF PROPOSED ALLOTMENTS FOR CALIFORNIA FIELDS

Fixed allotment fields—	Approved May potential	Proposed allotment
Beiridge	*8,950	*6,500
Brea-Olinda	22,670	9,500
Capitan	1,200	.....
Coalinga	33,510	8,000
Dominguez	*17,745	*11,500
East Coyote	3,730	1,450
Elwood	98,800	26,000
Fruitvale	7,830	2,250
Inglewood	21,850	14,400
Kern River	11,500	2,500
Lawndale	*300	*300
Los Angeles	*1,500	1,350
Lost Hills	*6,500	*2,100
McKittrick	*4,500	*2,500
Midway-Maricopa	*98,875	*52,500
Montebello	8,850	6,500
Round Mountain	*13,000	*1,200
Santa Maria	11,975	2,250
Summerland	*250	*250
Ventura Avenue	97,270	40,000
Ventura-Newhall	5,970	3,500
Watsonville	60	50
West Coyote	*12,400	*8,500
Wheeler Ridge	*590	550
Whittier	1,425	*1,350
Fixed field total	492,250	305,000
Variable allotment fields—		
Elk Hills	28,760	12,200
Huntington Beach	42,950	18,300
Kern Front	18,200	7,700
Long Beach	179,775	76,500
Mount Poso	20,900	8,900
New Fields	300	100
Playa del Rey	37,875	16,100
Potrero	1,250	550
Richfield	14,835	6,300
Rincon	3,020	1,300
Rosecrans	7,775	3,350
Santa Bar'ara	525	200
Santa Fe Springs	129,225	55,000
Seal Beach	24,970	10,600
Torrance	12,600	5,400
Variable field total	523,000	222,500
State total (ex Kettleman Hills)	1,015,250	427,500

The potential and allotments given do not include Kettleman Hills.
The proposed allotments for fixed fields represents an average reduction of 10 per cent from the current allotments except for those fields marked * where an additional reduction is considered practicable or where additional curtailment will be extremely difficult or impossible.

The proposed allotments for variable fields represent a proration on the basis of the approved potentials of the total amount of 222,500 bbls. daily available for all variable fields. Minor numerical adjustments of the exact figures have been made in order to express field allotments in readily comprehended round numbers.

Average curtailment of fixed fields—53.35 per cent.

Average curtailment of variable fields—57.45 per cent.

Kettleman Hills Holds Key

Kettleman Hills holds the key to the production situation in California until the new compulsory curtailment bill becomes effective. The statewide committee of oil operators recognized this dominating position and adopted the following resolution:

"Be it resolved that the proposed allotments of crude oil production for California fields, ex Kettleman, as shown on the trial schedule submitted to the general committee this day, May 27, be adopted by this meeting subject to Kettleman Hills Field keeping its production at 60,000 bbls. daily or under for the period from June 1, 1931, to January 1, 1932; and it is understood that the purchasing companies will purchase all such oil offered under such curtailment if and during the time the said state curtailment remains effective at 427,500 bbls. daily ex Kettleman Hills during such period. Be it further resolved that the 427,500 bbls. State allotment, ex Kettleman, shall prevail for the full period subject to resurvey of the allotments of the respective fields effective on September 1, 1931, and in the event any major or glaring discrepancies shall appear as a result of such survey pursuant thereto, readjustments may be then made between fields to correct same."

Under the new curtailment schedule, 25 fields with an aggregate potential daily production of 492,250 bbls. have been placed in a group with fixed allotments and 15 fields having an estimated daily potential of 523,000 bbls. in a second group which has variable allotments. Fields with fixed allotments include Beiridge, Brea Olinda, Capitan, Coalinga, Dominguez, East Coyote, Elwood, Fruitvale, Inglewood, Kern River, Lawndale, Los Angeles, Lost Hills, McKittrick, Midway-Sunset, Montebello, Round Mountain, Santa Maria, Summerland, Ventura Avenue, Ventura-Newhall, Watsonville, West Coyote, Wheeler Ridge and Whittier. The current allotment of this group is 218,750 bbls. per day and the proposed allotment 205,000 bbls. per day, a net reduction of 13,750 bbls. per day under the new curtailment schedule.

Fields With Variable Allotments

Fields with variable allotments include Elk Hills, Huntington Beach, Kern Front, Long Beach, Mount Poso, Playa Del Rey, Potrero, Richfield, Rosecrans, Santa Barbara Mesa, Santa Fe Springs, Seal Beach, Torrance and other minor fields. The current daily allotment of these fields with variable allotments is 256,250 bbls., as compared with a new allotment of 222,500 bbls., a net reduction under the new schedule of 33,750 bbls. per day. The total daily potential production of the State, ex Kettleman Hills, was set by the committee at 1,015,250 bbls. The current allotment on the same basis was 475,000 bbls. and under the new schedule, 427,500 bbls., a net reduction of 47,500 bbls. per day. Kettleman Hills is placed in a separate group and assigned a maximum pegged allowable of 60,000 bbls. per day.

The new curtailment schedule effective June 1 is the result of a general survey completed by the economic committee on May 14 and submitted to the Oil Producers Sales Agency. Upon the completion of this economic survey, the general committee of 21 was asked to criticize it and break down the report in an effort to eliminate any discrepancies or inequalities. The report was then submitted to the general committee and in order to eliminate any criticism the potential daily proudction of each field was revised. The operators committee on statewide curtailment then submitted the completed report to all purchasing companies to ascertain if they would buy curtailed oil on this basis. The chairman of the general committee was subsequently informed that the buyers of the crude oil would pledge themselves to purchase all crude oil brought under curtailment in conformity with the new schedule.

Major Companies in Sympathy

Paul N. Boggs, chairman of the general committee on statewide curtailment, announced that major companies were in sympathy with the Oil Producers Sales Agency, the organization of which he said was the most constructive move undertaken in many years. Rush Blodgett, representing the Oil Producers Sales Agency, was unanimously elected a member of the general committee on statewide curtailment and will represent the association at all future meetings on curtailment. In addition to ratifying the new curtailment program, the general committee named a committee consisting of P. N. Boggs, A. T. Jergins, Ralph B. Lloyd, Hooper Dunbar, Ed McAdams and S. M. Mosher to wait on Governor Rolph and request him to sign the new compulsory curtailment bill at the earliest possible moment. The Oil Producers Sales Agency reported that members having an aggregate daily crude oil production of 146,000 bbls. had become members of the association and hopes were entertained that the agency would begin functioning as a unit in the very near future.

Assembly Bill No. 4, recently passed by the California legislature, has been the center of considerable discussion in Southern California during the past week. This bill, which will permit the city of Huntington Beach to lease tidelands adjoining the Huntington Beach Field for development, is up for the governor's signature or veto.

Fear Pollution of Beaches

Opposition to this bill comes from those fearful that such drilling in the shallow waters adjoining the Standard's Pacific Electric lease at Huntington Beach will pollute adjacent beaches. Proponents of the measure, however, insist that modern methods of drilling have been developed to such an extent that the possibility of pollution is practically negligible. The present string of wells extending along the beach they contend represent as much harm as could be done by tideland development. The bill in question transfers jurisdjction over Huntington Beach tidelands from the State of California to the city with the implied authority to lease these tidelands for oil field development.

Advantages claimed for the bill are the employment of several hundred men and the expenditure of not less than $1,000,000 with the result that municipal taxes at Huntington Beach will be reduced to a minimum. California operators welcomed the announcement that the United States Supreme Court would hear oral arguments on the constitutionality of the gas conservation law on October 5. This is of particular significance because if the validity of the gas conservation law is upheld it will permit state officials to employ both this measure and the compulsory curtailment bill to keep state production within bounds.

Playa Del Rey

Two new wells were put on production in the Playa Del Rey Field of Los Angeles Basin during the past week. The Herndon Petroleum Co. headed the completion list by finishing No. 2 Venice flowing 2,345 bbls. of exceptionally clean 23.2 gravity oil from 6,188 feet, the hole having been finished with a 4¾-inch liner carrying 278 feet of perforated. This well is of particular interest because of the fact that the 6⅝-inch water string was set above the Nodular shale, in contrast with the usual custom of setting pipe in the shale just above the conglomerate. This new well, bottomed in Schist at 6,188 feet, topped the Nodular shale at 5,951 feet and the conglomerate at 6,128 feet. The 6⅝-inch casing was landed and cemented at 5,930 feet.

The Union Oil Co. added a new well to its list of producers in this field by finishing No. 10 Townsite flowing 330 bbls. of exceptionally clean 23.1 gravity oil per day from the deep Recreation zone at 5,872 feet, the hole having been completed with a 4¾-inch liner including 123 feet of perforated. No. 1 Vidor, an outpost which the Union is drilling in

TANKER SHIPMENTS FROM LOS ANGELES TO ATLANTIC AND GULF COAST PORTS

Commodity—	Total this week	Daily average	Total last week	Daily average	This year to date	same time last year
Crude oil	.....	.....	.....	.....	.....	68,690
Fuel oil	.....	.....	.....	.....	.....	71,950
Diesel and gas oil	.....	.....	.....	.....	892,230	1,607,924
Gasoline	512,459	73,208	56,274	8,039	6,249,739	6,750,258
Kerosene	.....	.....	.....	.....	41,512	.....
Coastwise—						
Crude oil	162,021	23,146	551,099	78,728	8,663,364	6,234,427
Fuel oil	296,891	42,413	280,820	40,117	5,691,586	7,064,352
Diesel and gas oil	108,232	15,462	47,499	6,786	727,718	763,751
Gasoline	394,242	56,320	296,725	42,389	5,192,061	4,544,670
Kerosene	9,987	1,427	.....	.....	157,028	71,497
Naphtha distillate	.....	.....	.....	.....	4,953	.....
Exports—						
Crude oil	126,711	18,387	219,544	31,363	2,763,067	2,584,436
Fuel oil	409,871	58,553	390,108	55,730	6,309,147	7,283,513
Diesel and gas oil	64,078	9,154	152,066	21,724	1,502,683	1,941,490
Gasoline	212,768	30,395	252,673	36,096	4,023,972	6,409,734
Kerosene	.....	.....	36,907	5,272	596,136	1,522,476
Lubricants	.....	.....	.....	.....	15,975	10,082

TANKER SHIPMENTS FROM SAN FRANCISCO TO ATLANTIC AND GULF PORTS

Diesel and gas oil	.....	.....	.....	.....	.....	38,280
Gasoline	71,220	10,174	.....	.....	338,719	511,950
Lubricants	.....	.....	.....	.....	14,015	5,366
Coastwise—						
Fuel oil	151,195	21,599	13,909	1,989	1,757,502	1,559,877
Diesel and gas oil	69,887	9,984	.....	.....	158,643	143,894
Gasoline	34,988	4,998	68,111	9,730	1,175,406	1,667,323
Kerosene	5,502	786	10,057	1,437	115,941	119,387
Naphtha distillate	49,780	7,111	.....	.....	49,780	.....
Exports—						
Crude oil	.....	.....	71,546	10,221	77,556	3,075
Fuel oil	63,140	9,020	55,331	7,904	515,395	448,060
Diesel and gas oil	.....	.....	.....	.....	232,388	178,990
Gasoline	94,435	13,491	60,324	8,703	1,604,329	1,532,369
Kerosene	96,081	13,726	30,105	2,872	409,142	272,049
Lubricants	.....	.....	.....	.....	.....	1,177

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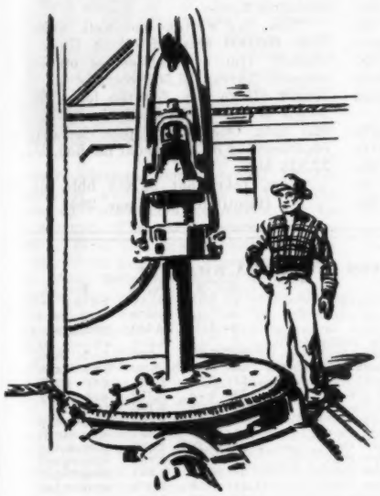
With Elesco Superheater Boilers



IN many ways Elesco superheater-equipped boilers provide lower drilling expense. Smaller boilers—superheater equipped—will do the same work that was done before with larger, higher pressure boilers.

Where four 125-hp. boilers carrying 350-lb. pressure were required before, three 125-hp. Elesco superheater boilers carrying only 250-lb. pressure are operating the same rig at faster speeds today.

This reduces the initial boiler investment, and because the pressure is lower the boilers last longer and the maintenance expense is less.

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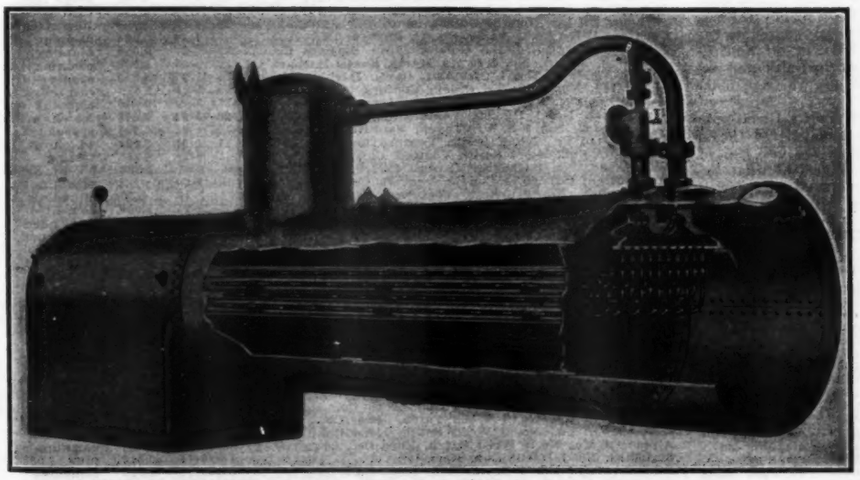
Utilization of Elesco superheater-equipped boilers insures a greater return per dollar of investment for equipment and per dollar of expense for wages on every well you drill.



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OG 6-4-31

the extreme eastern part of the Playa Del Rey Field, has been undergoing a series of production tests during the past week. This well apparently has sufficient oil to result in a satisfactory completion but apparently does not have sufficient gas to result in a natural flow. It has a tendency to build up a small head at infrequent intervals but upon exhaustion of the pressure remains inactive until swabbed again. Two or three additional wells are nearing completion in the Playa Del Rey Field at the present time, upon the conclusion of which very little future work will be undertaken.

Kettleman Hills

The Standard Oil Co. focused the attention of operators on the North Dome of Kettleman Hills late this week by completing a new well flowing 14,000 bbls. of clean 37 gravity oil and 12,500,000 feet of natural gas per day. This new producer, the Standard's first big well at Kettleman Hills, was bottomed in the deep zone at 7,952 feet and finished with a 6⅝-inch oil string carrying 967 feet of perforated. As a consequence of this completion daily production of Kettleman Hills again exceeds 50,000 bbls. per day and a further increase is expected early in June. During the early part of last week production had been reduced to 39,500 bbls. per day when the Superior Oil Co. pinched back No. 2 Huffman to 999 bbls., but the Standard's completion sent production soaring again. A check of development work under way in the Kettleman Hills Field indicates the probability that at least four additional wells will be finished between now and the end of June. The Standard is making preparations to finish another new well in this field some time within the next few weeks and the Kettleman North Dome Association is rushing work ahead on three other projects listed for early completion.

The Union Oil Co., Shell and Associated should also be in a position to finish new wells in this field unless mechanical trouble develops at the last moment. Plans are being perfected to redrill and deepen several upper zone producers in the North Dome at Kettleman Hills in order to eliminate the waste of natural gas. The Kettleman North Dome Association recently let a contract calling for the initiation of control work on No. 8-12P and No. 88-2P, the aggregate production of natural gas of which approximates 130,000,000 feet per day. The association plans to redrill and deepen No. 8-12P to the deep Ochsner zone but No. 88-2P will probably be indefinitely suspended because of mechanical trouble. The Standard has announced plans for the killing and deepening of its No. 38-35J, which is at present producing 1,510 bbls. of oil and 52,550,000 feet of natural gas per day.

Less Drilling Expected

The new curtailment schedule which gives Kettleman Hills a pegged allowable daily production of 60,000 bbls. will probably be reflected in development work, although no general suspension is anticipated for the present. It is quite probable, however, that drilling operations in the North Dome will be severely curtailed if California's new compulsory curtailment bill is effectively enforced. This deduction is based on the assumption that operators will not continue expending substantial sums for the drilling of new wells if upon completion they must be shut in because they cannot be produced without violating the State's curtailment measure. The Superior Oil Co. has secured itself against loss of its 160-acre Huffman lease in the North Dome by consummating an agreement to pay the trustees of the British American Oil Co. $25,000 for the privilege of keeping the lease in the event that the trustees are successful in their suit to quiet title now held by the Huffman interests. The discovery of prolific production in the North Dome at Kettelman Hills has been a boon to Kings County as the $1,086,894 representing total tax collections was approximately $300,000 in excess of last year due to tax collections on oil property and equipment in the North Dome.

The Superior Oil Co. completed a production test on No. 2 Huffman during the early part of the week and this well produced 7,030 bbls. in eight hours, or at the rate of 21,090 bbls. per day. The test was made through three beans measuring 77/64-inch, 87/64-inch and 102/64-inch. Gas production was at the rate of 17,800,000 feet per day, the flow being directed through seven high pressure gas traps. The well has been pinched back very substantially, production during the past 24 hours approximating 1,024 bbls. For the week ending May 16 the Associated Oil Co. produced 9,672 bbls. of oil and 141,372,000 feet of natural gas. The Kettleman North Dome Association produced during the same period 19,983 bbls. of oil and 929,791,000 feet of natural gas. The Standard Oil Co. produced in the same period 54,283 bbls. of oil and 1,493,983,000 feet of natural gas and reported a shrinkage of gas waste of 550,105,000 feet.

Universal's Well Looks Good

The Universal Consolidated Oil Co., a subsidiary of the Richfield Oil Co. of California, has cored 31 feet of what appears to be a good oil sand in its well

(Continued on Page 304)

CAPERS TELLS EAST TEXANS THEY CANNOT MAKE MONEY ON 20-CENT OIL

LONGVIEW, Tex., June 1.—Many thousands of barrels of East Texas oil has been sold at 20 cents per barrel at the well. The present highest posted price for 39 gravity crude is 35 cents per barrel and is considerably above the price at which most of the oil from this field is being purchased by refiners not posting prices. So much of the product is being sold at an average of 20 cents per barrel that A. B. Capers, local proration umpire, and practical oil man, has done some figuring to find if a producer can make any money at 20 cents per barrel on a recovery even as high as 30,000 bbls. to the acre. According to Mr. Capers' figures the producer cannot do it. According to Mr. Capers the producer loses money on his first 100,000 bbls. of oil taken from 10 acres; and makes little if any on his second and third 100,000 bbls.

Mr. Capers declares that the facts have caused operators holding leases to be paid for with crude oil to forfeit the leases, as they cannot see their way to carrying out drilling contracts with the fear of a 20-cent general price staring them in the face.

"Take a 10-acre lease," Mr. Capers said. "In the East Texas Field, ordinarily, one would have to drill three wells on such a lease to protect it against offsets. All these figures are minimum—say a minimum of three wells. Here are the costs: Derrick, $1,000; casing, $3,500, second hand at that; cement, $500; tubing, $1,000; separator and tanks, $1,500; well head and connections, not counting christmas trees, $500; labor and teams, etc., outside actual drilling operations paid for by drilling contractor, $500. There you have $8,500, a very conservative figure.

"Now, say we take one well. Take the first 100,000 bbls. of oil at flush production. Out of that comes one-eighth royalty, leaving 87,500 bbls. of oil. One-fourth off to pay for the lease in oil, which is the usual method, leaves 65,625 bbls. One-half to pay the drilling contractor in oil, the usual method, leaves 32,813 bbls.

"Now, take that 32,813 bbls. at 20

(Continued on Page 264)

IMPORTANT SOUTHERN CALIFORNIA WILDCATS

Company, well and location—	S-T-R	Depth	Status
Olympic Realty Corp., No. 1 Barnes, Los Angeles Co.	14- 2-15	5,315	hd. sd. drilling
Hines Pet., No. 1 Ocean Park, Los Angeles Co.	9- 2-15	6,177	br. sh. drilling
Taylor Oil Co., No. 1 Culver, Los Angeles Co.	12- 2-15	6,238	suspended
Mesmer City Corp., No. 1 Mesmer, Los Angeles Co.	24- 2-16	5,995	sd. sh. drilling
Dwyer & Becker, No. 1 Compton, Los Angeles Co.	17- 3-13	4,520	suspended
Allison Synd., No. 1 Baldwin, Los Angeles Co.	8- 2-14	5,110	suspended
Cal. Ventura Oil Co., No. 1 Manhattan, Los Angeles Co.	30- 3-14	6,525	suspended
Cal. Ventura Oil Co., No. 1 Hermosa, Los Angeles Co.	31- 3-14	3,396	suspended
Cal. Ventura Oil Co., No. 2 Hermosa, Los Angeles Co.	31- 3-14	3,300	suspended
Cal. Oilfields Corp., No. 1 Hermosa, Los Angeles Co.	31- 3-14	2,560	suspended
Carnjol Oil Corp., No. 1 Hermosa, Los Angeles Co.	31- 3-14	3,114	cleaning out
Hermosa Expl. Co., No. 1 Hermosa, Los Angeles Co.	31- 3-14	3,050	cleaning out
Kellogg, W. R., No. 1 Hermosa, Los Angeles Co.	6- 4-14	2,645	cleaning out
Westwood Pet., No. 1 Hermosa, Los Angeles Co.	6- 4-14	3,200	50 bbls. daily
Tulsa Oil Co., No. 1 Hermosa, Los Angeles Co.	6- 4-13	3,060	cleaning out
McMahon & McDonald, No. 1 Watts, Los Angeles Co.	12- 3-14	4,665	suspended
Staple Oil Co., No. 1 Manhattan, Los Angeles Co.	24- 3-15	1,580	sd. sh. drilling
York & Smullin, No. 1 Watson, Los Angeles Co.	29- 4-13	3,860	sd. sh. drilling
Wilmington Consd., No. 1 Watson, Los Angeles Co.	17- 4-13	1,013	suspended
Brubaker, W. O., No. 1 Van Nuys, Los Angeles Co.	11- 2-15	2,700	suspended
Rucker & Croul, No. 2 Puente, Los Angeles Co.	27- 2-10	3,200	suspended
Arden Oil Co., No. 1 Puente, Los Angeles Co.	15- 2-10	3,325	suspended
D. & B. Oil Co., No. 1 Puente, Los Angeles Co.	3- 2-10	4,620	suspended
El Dorado Oil Co., No. 1 Puente, Los Angeles Co.	30- 2- 9	1,092	suspended
Marcel Pet. Co., No. 1 Puente, Los Angeles Co.	31- 2- 9	3,100	suspended
Cadahy Oil Co., No. 1 Bell, Los Angeles Co.	30- 2-12	1,370	recemented
The Texas Company, No. 1 Montebello, Los Angeles Co.	4- 2-12	3,725	hd. sd. drilling
Huntington Cent. Oil Co., No. 1 Montebello, Los Angeles	34- 1-11	mtl.	building rig
Hammer, Fred, No. 1 Alhambra, Los Angeles Co.	24- 1-13	3,412	suspended
Los Gatos Oil Co., No. 1 El Monte, Los Angeles Co.	16- 1-11	2,280	suspended
Rucker, L. W., No. 1 Calabasas, Los Angeles Co.	26- 1-17	753	cleaning out
Olympic Corp., No. 1 Calabasas, Los Angeles Co.	18- 1-17	5,725	hd. sd. drilling
Ness Pet., No. 1 Newport, Orange Co.	21- 6-10	4,910	suspended
Hall, H. L., No. 1 Newport, Orange Co.	20- 6-10	790	suspended
Gesell, T. P., No. 1 Newport, Orange Co.	29- 6-10	1,470	cleaning out
Standard, No. 1 Newport, Orange Co.	26- 6-10	4,791	hd. sd. drilling
Western Gulf, No. 1 Santa Ana, Orange Co.	13- 3- 8	3,267	suspended
The Texas Company, No. 1 Olive, Orange Co.	7- 4- 9	5,470	abandoning
Gleck Oil Co., No. 1 Sunset Beach, Orange Co.	20- 5-11	4,160	gr. sd. drilling
Western Gulf, No. 1 Santa Ana, Orange Co.	12- 3- 8	3,267	suspended
Beck, F. A., No. 1 Corona, Riverside Co.	8- 4- 6	481	sd. sh. drilling
Beck, F. A., No. 1 Beaumont, Riverside Co.	1- 3- 1	520	sd. sh. drilling
Grey, H. H., No. 1 Redlands, San Bernardino Co.	25- 1- 3	2,392	suspended
Borderland Oil Co., No. 1 Encinitas, San Diego Co.	12-13- 4	2,519	suspended
Borderland Oil Co., No. 1 Point Loma, San Diego Co.	30-16- 3	4,966	hd. sd. drilling
South Bay Oil Co., No. 1 Border, San Diego Co.	31-18- 2	....	location
Carr, O. K., No. 1 Capistrano, San Diego Co.	13- 8- 5	5,250	cleaning out

IMPORTANT NORTHERN CALIFORNIA WILDCATS

Company, well and location—	S-T-R	Depth	Status
Western Gulf, No. 1 Santa Maria, Santa Barbara Co.	5- 9-35	6,650	hd. sd. drilling
Fields Gas Co., No. 1 Santa Maria, Santa Barbara Co.	8- 9-34	5,570	suspended
Barnsdall, No. 1 Gato Ridge, Santa Barbara Co.	9- 8-32	6,510	plugging back
Midwest Oil Co., No. 1 Los Alamos, Santa Barbara Co.	2- 7-33	2,200	sd. sh. drlg.
Smith, W. E., No. 1 Lompoc, Santa Barbara Co.	18- 7-34	100	tech. spud
Zaca Oil Co., No. 1 Los Alivas, Santa Barbara Co.	20- 7-31	mtl.	building rig
General Pet., No. 1 Goleta, Santa Barbara Co.	21- 4-28	4,533	gas—shut in
General Pet., No. 2 Goleta, Santa Barbara Co.	21- 4-28	4,350	gas—shut in
General Pet., No. 3 Goleta, Santa Barbara Co.	21- 4-28	5,183	testing
General Pet., No. 133 Goleta, Santa Barbara Co.	21- 4-28	2,030	suspended
General Pet., No. 134 Goleta, Santa Barbara Co.	21- 4-28	2,053	suspended
General Pet., No. 136 Goleta, Santa Barbara Co.	21- 4-28	2,047	suspended
General Pet., No. 137 Goleta, Santa Barbara Co.	21- 4-28	2,050	suspended
General Pet., No. 138 Goleta, Santa Barbara Co.	21- 4-28	4,931	suspended
General Pet., No. 139 Goleta, Santa Barbara Co.	21- 4-28	2,051	suspended
Boles Oil Co., No. 140 Goleta, Santa Barbara Co.	22- 4-28	1,040	suspended
U. S. Pet., No. 141 Goleta, Santa Barbara Co.	20- 4-28	1,035	suspended
U. S. Pet., No. 142 Goleta, Santa Barbara Co.	20- 4-28	2,012	suspended
U. S. Pet., No. 143 Goleta, Santa Barbara Co.	20- 4-28	1,019	suspended
El Camino, No. 149 Goleta Tideland, Santa Barbara Co.	22- 4-28	1,035	suspended
South. Cal. Drlg. Co., No. 1 Goleta, Santa Barbara Co.	12- 4-29	3,094	Sespe form.
Bolsa Chica, No. 191 Goleta, Santa Barbara Co.	24- 4-29	4,191	testing
Bellview Oil Co., No. 159 Goleta, Santa Barbara Co.	24- 4-29	2,099	suspended
Cochran, J. H., No. 1 Naples, Santa Barbara Co.	7- 4-29	5,134	cleaning out
Johnson, George, No. 1-A Goleta, Santa Barbara Co.	19- 4-27	3,050	reaming
Sovereign Oil Co., No. 1 Santa Maria, Santa Barbara Co.	20-10-35	5,500	cleaning out
Pacific Western, No. 1 Gibraltar, Santa Barbara Co.	14- 5-27	2,345	suspended
Associated, No. 1 Rincon Creek, Ventura Co.	19- 4-24	2,080	suspended
C. C. M. O. Co., No. 7-A Rincon, Ventura Co.	7- 3-24	10,030	cleaning out
Continental, No. 1 Rincon, Ventura Co.	23- 3-24	5,070	sd. sh. drilling
Pure Oil Co., No. 1 S. P. Canyon, Ventura Co.	15- 4-21	2,591	suspended
Superior Oil Co., No. 1 Sespe, Ventura Co.	14- 4-21	6,900	sd. sh. drilling
Merchants Pet., No. 1 Sespe, Ventura Co.	1- 4-20	1,285	testing
Magu Synd., No. 1 Oxnard, Ventura Co.	17- 1-21	3,950	hd. sd. drilling
Mex Cal Oil Co., No. 1 Conejo, Ventura Co.	12- 1-20	188	cleaning out
Hansen Pet., No. 1 Conejo, Ventura Co.	24- 1-20	230	hd. sd. drilling
Wilshire Oil Co., No. 1-A Buttonwillow, Kern Co.	7-29-24	7,000	cemented
Kent & McDonald, No. 1 Temblor Hills, Kern Co.	3-32-22	1,672	suspended
Federal Drlg. Co., No. 1 Buena Vista, Kern Co.	20-31-24	5,367	suspended
General Pet., No. 1 Belridge, Kern Co.	30-28-21	4,540	set pipe
The Texas Company, No. 1 Belridge, Kern Co.	22-27-20	5,045	suspended
Standard, No. 2 Belridge, Kern Co.	31-27-20	5,540	reaming
Ohio Oil Co., No. 1 Belridge, Kern Co.	36-27-20	5,980	suspended
Reward Oil Co., No. 1 Belridge, Kern Co.	34-27-20	5,440	oil sand
Continental, No. 1 Belridge, Kern Co.	36-27-20	4,804	sd. sh. drilling
Wallace, K. C., No. 1 Belridge, Kern Co.	32-29-21	4,222	recemented
Rational Pet., No. 1 Shale, Kern Co.	2-27-18	2,355	redrilling
Wicher, Sy, No. 1 Arvin, Kern Co.	12-30-28	1,250	suspended
Shell, No. 1 Weed Patch, Kern Co.	29-30-29	8,460	plug 7,900 ft.
Shell, No. 2 Weed Patch, Kern Co.	29-30-29	6,410	suspended
Shell, No. 3 Weed Patch, Kern Co.	32-30-29	5,714	sd. sh. drilling
Osborn, Colter, No. 1 Weed Patch, Kern Co.	15-30-29	3,550	sd. sh. drilling
Mohawk Oil Co., No. 1 Weed Patch, Kern Co.	32-30-29	6,150	suspended
Mohawk Oil Co., No. 2 Weed Patch, Kern Co.	4-31-29	rig	suspended
Alpine Oil Co., No. 1 Weed Patch, Kern Co.	13-31-29	3,785	cleaning out
Standard, No. 1 Devils Den, Kern Co.	14-25-18	3,313	plug 2,035 ft.
Hannah, Tom, No. 1 Devils Den, Kern Co.	25-25-18	2,925	cemented
Cumberland Oil Co., No. 1 Devils Den, Kern Co.	21-26-18	1,590	suspended
Colter, R. T., No. 1 Blackwell Corner, Kern Co.	14-26-19	50	sd. drilling
E. J. Miley, No. 1 Backwell Corner, Kern Co.	17-26-19	rig	suspended
Shell, No. 1 Semitropic, Kern Co.	17-27-23	9,700	cleaning out
Moran & DeCamp, No. 1 Mojave, Kern Co.	26-10-14	750	suspended
Kendall Dev. Co., No. 1 Mojave, Kern Co.	27-11- 9	496	sd. sh. drilling
Meridan Oil Co., No. 1 Antelope, Kern Co.	11- 9-15	3,804	suspended
Ritchie, J. J., No. 1 Tejon, Kern Co.	33-11-19	5,750	sd. sh. drilling
Associated, No. 1 Jacalitos, Fresno Co.	22-21-15	4,700	sd. sh. drilling
Panoruma Oil Co., No. 1 Carizzo, San Luis Obispo Co.	7-31-31	4,019	fishing
Tray El Oil Co., No. 1 Carizzo, San Luis Obispo Co.	7-32-22	1,572	hd. sd. drilling
Cities Service, No. 1 Creston, San Luis Obispo Co.	20-28-15	417	sd. sh. drilling
Latin Amer. Pet., No. 1 Shandon, San Luis Obispo Co.	21-27-15	4,615	recemented
Schilling, C., No. 1 Atascadero, San Luis Obispo Co.	24-28-12	1,180	sd. sh. drilling
Schockley, C., No. 1 Pismo, San Luis Obispo Co.	13-32-13	3,094	suspended
Pacific Inland, Well No. 1, Monterey Co.	19-23-15	1,324	hd. sd. drilling
Irma Investment Co., No. 1 Dudley Ridge, Kings Co.	7-23-20	1,345	testing
O'Donnell, J. E., No. 1 Dudley Ridge, Kings Co.	7-23-20	1,635	gas well—idle
Valley Expl. Co., No. 1 Dudley Ridge, Kings Co.	20-23-20	3,750	cleaning out
Kettleman Lakeview, No. 1 Tulare Lake, Kings Co.	11-23-19	1,304	cleaning out
Purman, T. H., No. 1 Reef Ridge, Kings Co.	36-23-17	3,595	cleaning out
Seymour, L. W., No. 1 Avenal, Kings Co.	10-23-18	1,148	cleaning out
Utah Dev. Co., No. 1 Pyramid Hills, Kings Co.	13-24-18	....	material
Twin State Oil Co., No. 1 Point Arena, Mendocino Co.	14-12-17	6,630	sd. sh. drilling
Orinda Pet., Well No. 1, Contra Costa Co.	32- 1- 3	2,012	cleaning out
Pettingall, C. E., No. 1 Porterville, Tulare Co.	15-22-27	920	suspended
Knapp, George, No. 1 Porterville, Tulare Co.	20-22-27	780	suspended
Inland Valley Oil Co., No. 1 Visalia, Tulare Co.	24-17-24	2,092	suspended
Larson, S. E., No. 1 Tulare Lake, Tulare Co.	20-24-23	650	sd. sh. drilling
Colusa Oil Co., No. 1 Bush, Colusa Co.	31-15- 4	918	hd. sd. drilling
Oakdale Oil Co., No. 1 Oakdale, Stanislaus Co.	3- 2-10	4,163	hd. sd. drilling
Orland Oil Synd., No. 1 Orland, Tehama Co.	31-23- 3	2,520	redrilling
Sargent Oil Co., No. 1 Sargent, Santa Clara Co.	1-12- 3	rig	suspended

East Texas Committee Urges Action

Recommendations Sent to Railroad Commission at Austin. Lack of Outlet and Lack of Pressure Two Weighty Factors

By L. E. Bredberg
Fort Worth Bureau, The Oil and Gas Journal

FORT WORTH, Tex., June 1.—The East Texas Advisory Committee, composed of 11 members, met at Tyler, Tex., on May 29 to discuss conditions in the district in an effort to outline, if possible, some means of preventing further price cuts, cutting down production and helping to enforce conservation and common purchase phases of the existing laws. Five recommendations were adopted by the committee and have been sent to the Railroad Commission at Austin for its advisement. The first recommendation was to raise the present total allowable of the three producing areas from 160,000 bbls. daily to around 175,000 or 200,000 bbls. per day. The Railroad Commission has decided to let the present figure of 160,000 bbls. per day stand, at least until June 15, and possibly longer.

The committee asserted that proration in East Texas had broken down as enforced in its present state, but that funds should be made available for the enforcement of conservation and common purchase phases of the existing laws. It also concluded that the existing situation may be helped by an immediate testing of the present powers of the Railroad Commission by pressing pending litigation to a speedy conclusion, and that the present injunction delays may be prevented by additional legislation which might also provide for more drastic penalties against violators during the pendency of such injunctive litigation.

It was recommended that the chairman of the committee, Charles F. Roeser, and George D. Sears be named as a committee to present to the Railroad Commission facts in relation to the present condition of the East Texas fields as reported to the meeting, these facts to be substantially based on the number of producing wells in the fields, the potential of the fields, the allowables of the fields, the violations in the fields, the number of unconnected wells, the production by violators of present proration orders, and production by offsets to the violators, voluntary and involuntary.

Purchasers May Withdraw

Following the committee's idea that proration had broken down in the district, two of the major pipe line companies serving the fields stated that their companies would be forced to withdraw as purchasers in the fields if violations increased. Operators who have been holding out on prorating their leases are still divided in opinion, some of them changing and agreeing to follow the present orders in effect. H. L. Hunt of the H. L. Hunt, Incorporation, one of the largest producers and heaviest holders of leases in the district, especially the Joiner Field, has added his endorsement of proration, and wired the governor of Texas requesting him to take whatever steps may be necessary to fully enforce proration in the district through existing laws if adequate or through new legislation.

Beeman Strong, of the Yount Lee Oil Corp., spoke at the advisory committee meeting favoring legislative action, stating that two courses were open: complete abandonment of proration or adequate laws to enforce it. Last year he was one of the strong opponents of proration.

Only a relatively few violators are holding out against proration in the district, and as production continues to mount in the three producing areas, pipe lines do not or cannot connect with all the wells, especially the violators, and as outlets continue to decrease there will apparently be only one thing left for all producers to do and that is abide by the existing orders of the Railroad Commission, cut down their production to daily allowable apportioned to the wells in the various areas, and thereby obtain pipe line connections.

Although there are many major pipe lines, loading racks and refineries serving the district, with two more large lines under construction, two ready to be constructed and two others proposed, all of which will give a total daily outlet of over 500,000 bbls., these cannot hope to transport the present potential which is mounting every day due to flush producers being added to production. A total of 82 producers was added to the producing list this week, bringing the total number of producers above 700, or making an average of 100 completed producers brought in each month since the Joiner Pool was discovered October 9, 1930. The number of completions is increasing each week, and will soon reach the hundred mark each week instead of each month as the past average shows. Voluntary proration, or proration ordered by the Railroad Commission, may fail to function as desired, but it seems obvious that production and drilling will soon be curtailed by lack of outlet, and with many of the operators in the district in straightened circumstances, and "operating on a shoestring" curtailing their production.

Lack of Pressure

However, another side presents itself to those watching the outcome of the proration battle in the district, watching the flush production potentials grow, the pipe line and transportation activities, and all other phases and activities which the petroleum economists have to consider in making up their records, and strengthening or weakening their opinions. The rapidly diminishing flow of the flush production wells, and absolute discontinuance of flow of many wells of the field proves beyond doubt that lack of pressure in the fields will soon lend a hand in cutting down production throughout the district, and already has proven itself an ally of those favoring proration.

Companies and operators alike are installing pumping units on many of their wells, in many cases, as soon as the well is completed, merely preparing for what they expect to have to do within a short time, put the wells on the pumps. This cannot be better proven than by a personal trip through the fields where the pumping units are readily discernible. It will also be discovered that wells which have come in for an initial of from 15,000 to 20,000 bbls. flush production, have already fallen off to 500 bbls. per day or less, flowing open.

However, the many hundreds of undrilled, but proven acres of land lying within the producing areas will furnish hundreds of thousands of barrels of flush production, but they, too, are expected to have low pressure, and will consequently fall off rapidly on production, especially if they are allowed to flow at capacity, and are not pinched in to meet proration requirements.

Salt water was first considered a bugaboo in the Kilgore Pool, and was feared in all three pools, but wells which were making a considerable amount of water in the former pool have been plugged back and the water entirely shut off, or they have been pinched in to where they are making but a negligible amount of water, consequently this dread has been somewhat overlooked, while the low pressure facts continue to increase throughout the district.

High lifting costs added to the expense of the leases and drilling costs, will cause losses to be incurred in developing properties at the present prices paid for the crude, and many operators who are now stared in the face by the necessity of putting pumping units on their wells, are no doubt casting about for a purchaser of their properties, and wondering how they will bear the added burden of such production costs, if they cannot slide out from under the leases which may otherwise become "white elephants" on their hands.

Nearly 600 Wells Drilling

There is now a total of 559 wells drilling in the East Texas district, with over 700 on production. One hundred and forty first reports were issued in the district this week, and 82 completions were reported, the majority of these being in Rusk and Gregg County.

On May 27 there were 88 wells in the Longview area producing 71,785 bbls., an increase of 31 wells and 10,275 bbls. over the present week. In the Kilgore area there were 275 wells producing, or capable of producing, 156,414 bbls. per day, an increase of 42 wells and 32,149 bbls. over the previous week. In the Joiner area there were 253 wells producing 121,048 bbls., or an increase of 23 wells with 3,012 bbls. over the previous week. This makes a total of 616 wells producing on May 27, making a total production of 349,247 bbls., or an increase of 96 wells and 45,435 bbls.

Runs to pipe lines were slightly over 164,000 bbls., tank car shipments around 142,795 bbls., and local refineries ran 10,505 bbls., while 31,950 bbls. went to storage each day. The total daily allowable for the three districts is 165,000 bbls. per day, or over 184,000 bbls. less than that produced and transported.

All major pipe line and purchasing companies in the East Texas district have met Humble Oil & Refining Co.'s postings of May 26, which made top price of East Texas crude 37 cents per barrel for crude of 40 degrees gravity and above. Tidal Refining Co., which formerly had a posting of 40 cents, met the new postings on May 30.

New Outlets

The Humble Pipe Line Co. announced it would build a 10-inch line from its pumping station south of Longview in Gregg County to Moore Station near Shreveport, La., and would also build a 25-mile loop between its Joiner Field station in Rusk County to Jacksonville in Cherokee County, and an additional loop between that point and Groesbeck station in Limestone County. It already has a 10-inch line in operation between Kilgore, Joiner Field and Boggy Creek.

The Magnolia Pipe Line Co. has a 10-inch in operation from Gregg County to Center Station in Shelby County and is now surveying for a 10-inch line from Gregg County to Corsicana, where it will connect with its 12-inch main line running to the Gulf Coast. This will give the company an additional 40,000 to 45,000-bbl. per day outlet.

Another rumor states that the Shell Pipe Line Co. will lay a 10-inch line from Gregg County, where it has several hundred proven acres, to Houston, where it has a large refinery. Some time ago

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EAST CENTRAL TEXAS WILDCATS

Week Ending June 1

Company, well, farm name, section and block— Remarks:

ANDERSON COUNTY

Riango Oil Co.'s No. 1 J. Lynn, 1,400 ft. from NE line and 7,425 ft. from E line of survey, R. Brown Sur.—Set 10-in. csg. 210 ft.

H. B. McConnell et al's No. 1 N. B. Watson, 500 ft. from W line and 4,850 ft. from N of S line of survey in S half of 129-ac. tract, M. Main Sur.—Location.

ANGELINA COUNTY

R. O. Moore's No. 1 Abney Estate, 50 ft. N of Blk. No. 6, immediately out of city limits of Lufkin—T. D. 1,350 ft.; set 6⅝-in. csg.; bailed dry.

Pollick Oil Co.'s No. 1 Sessions, 1,250 ft. from N and 1,250 ft. from E line of Jesus De La Garza Sur.—Shut down 3,600 ft.

BOWIE COUNTY

Tom Bell's No. 1 Merritt, 1,225 ft. from N and 875 ft. from E line of survey, T. S. McKinney Sur.—Drlg. 2,550 ft.

Devore and Midfield's No. 1 Roy B. Cooper, 250 ft. from N and 250 ft. from E line of Cooper 115-ac. tract, W. M. Ward Sur.—Drlg. 1,950 ft.

Parkeling-Jones et al's No. 1 W. W. Whybark, 200 ft. from S and W of SW cor. of J. A. Dyer Sur.—Derrick.

Lee Timberlake et al's No. 2 Julius N. Tidwell, 655 ft. from E and 2,510 ft. from S of survey in L. M. Rice Sur.—Salt water on drill stem test; shut down 3,000 ft.

CAMP COUNTY

W. E. Duke et al's No. 1 L. B. McCaslen, 2 miles NW of Lafayette, Mary Hays Sur.—Digging pit.

CHEROKEE COUNTY

Ben Banner's No. 1 J. Williams Estate, 150 ft. S and 300 ft. W of SE cor. of the N. Hogg heirs and in the J. L. Hogg heirs Sur.—Drlg. 3,459 ft.

D. H. Byrd et al's No. 1 Dixie, 1,385 ft. from N along E line of G. W. Forman Sur. from NW cor. of W. H. Felder 354-ac. tract and 150 ft. W at right angles to E line—Drlg. 4,062 ft.

Grey et al's No. 1 McGee, 1,600 ft. from W and 200 ft. S of NE cor. of McKnight Sur.—Shut down 3,477 ft.

Helen-Clare Oil Co.'s No. 1 Mrs. M. P. Perkins, 1,800 ft. from N and 450 ft. from W of survey, Thomas Stafford Sur.—Rig up.

Rowan Nichols and Tidal Oil Co.'s No. 1 W. T. Norman, 330 ft. W of E line and 950 ft. N of S line, J. H. Irby Sur.—Drlg. 1,560 ft.

William A. Stone's No. 1 Blount Decker, 900 ft. E of E line of S. Selman Sur. and 1,200 ft. S of N line of E. M. Decker 406-ac. tract in George Ruddle Sur.—Drlg. 4,815 ft.

Walton Oil Co.'s No. 1 E. Singletary, 250 ft. W and 150 ft. N of NE cor. of M. Lacey Sur. and in Walters Sur. on Singletary 84-ac. tract—T. D. 2,960 ft.

DALLAS COUNTY

Paris' No. 1 Wilkinson, 2,787 ft. from NW and 3,241 ft. from SW of John P. Anderson Sur.—T. D. 870 ft.; shut down.

DELTA COUNTY

Delta Development Co.'s No. 2 Mallie Ablowich, 300 ft. S of No. 1 Cooper, Townsite Sur.—Shut down 3,112 ft.

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Two Wildcats May Open New Pools

One in Schleicher County and Another Northeast of Penn Pool in Ector County. Jones County Test Draws Attention

By L. E. Bredberg
Fort Worth Bureau, The Oil and Gas Journal

FORT WORTH, Tex., June 1.—While operators and companies and administrative bodies of the State of Texas are trying to prorate the gigantic East Texas Field, bring order out of chaos, and prevent crude oil prices from tobogganing to a 10-cent level, wildcatters continue to drill throughout other districts in the State, some of the wildcats now showing up as potential openers of new pools. One Schleicher County wildcat, and an Ector County wildcat look like two such discoveries, although the latter well does not have much to substantiate present beliefs. It may, however, encounter a heavier showing, and log a pay formation correlating with the Penn Pool, and prove the forerunner of the third pool for the county.

J. W. Wessner and others' No. 1 Nicks, in Section 77, Block LL, T.C. Survey, approximately 1 mile northeast of Eldorado, and 3 miles southeast of Phillips Petroleum Corp.'s deep test which was recently abandoned at 6,880 feet after encountering a good oil showing from 3,912-25 feet, is now appearing as a possible pool opener with 1,800 feet of oil in the hole which rose in about 4 hours' time. The first oil show was logged at 3,995 feet, and an increase was struck from 4,000-02 feet when the oil rose 850 feet in the hole. Four more feet of hole was drilled, to the present total depth of 4,006 feet where it is shut down waiting on casing, the hole having bridged around 3,700 feet. The oil seems to be void of sulphur, and the test is making an estimated 1,000,000 feet of gas as it now stands.

The Phillips Petroleum Co., Shell Petroleum Corp., Sun Oil Co., Gulf Production Co. and Humble Oil & Refining Co. own the majority of leases around the Nicks test, and even if it makes a commercial producer opening up the first field for Schleicher County, which lies in the Edwards Plateau region, these companies will no doubt refrain from drilling their acreage, and will shut down the pool as long as possible due to the inopportune time for such a discovery opening up another pool in the face of the present chaotic conditions of the industry.

There are three major trunk lines running from West Texas to the Gulf Coast, within a few miles of the Nicks test, but it is doubtful if any of these lines would connect with the well, and as it is situated far from any possible market, shipping the crude at the present prices paid in the Permian Basin would no doubt tend to hold down activities in the area.

Ector County

Penn Oil Co.'s No. 1 Cowden, in Section 12, Block 44 Township 2s, T.&P. Survey, approximately 8 miles northeast of the Penn Pool, Ector County, aroused more interest in this sector this week when it had a rainbow showing of oil at 4,040-50 feet in gray lime. It is now drilling ahead at 4,105 feet in lime with no further increases. Elevation is 3,047 feet. Other tests in various parts of the county have had such showings, and such a showing in this test does not presage a whole lot for the area, although there is the possible chance of it opening up the third pool for the county, extending to the north on a "high" which many consider as likely area for production.

Jones County Wildcat

Another wildcat which is drawing attention to another part of West Texas is Andy Urban and others' No. 1 Riddle, in the A. W. Hill Survey, Jones County. It swabbed 100 bbls. in 72 hours from sand topped from 1,705-20 feet, and is drilling ahead at 1,740 feet without change.

All available storage has been filled in the Pecos Valley Pool, Pecos County, and the 15 producing wells in the pool have been shut in waiting completion of a small line which is being constructed into the pool to connect with the Wickett Pipe Line Co.'s line which runs from the company's refinery on the Texas & Pacific Railroad, south to the Grand Falls Pool.

WICHITA FALLS DISTRICT

The Stanolind Crude Oil Purchasing Co. announced a reduction in crude prices, effective 7 a.m. today, cutting the price of crude in the North and North Central Texas districts, and following last week's reductions of prices in the East Texas district. Twenty-eight degree gravity oil is cut to 25 cents, with a 1-cent differential up to 40 gravity and above, making top price 37 cents.

This cut may have great weight in bringing about the shutting in of several hundred small producers in the North and North Central Texas districts as many of the operators and companies had already considered such a movement before this price went into effect today. Wells that can be shut in where possible, without permanently killing them, will probably be shut in indefinitely or until the market improves and merits opening the wells. Total production of the district is between 58,000 and 60,000 bbls. per day, and pipe lines have been running about two-thirds of this amount daily. This is one example of what East Texas production may possibly mean to thousands of wells throughout the country. Many small producers in the two districts have already been abandoned during the past few months.

COMPLETIONS IN WEST TEXAS

Pecos County

Hagen and others' No. 1 Shearer, dry and abandoned, total depth 1,825 feet.

Reeves County

The California Co.'s No. 2 Abrams, dry and abandoned, total depth 4,509 feet.

Ward County

Alpine Oil & Development Co.'s No. 3 Boogher, elevation 2,443 feet, top salt 810 feet, top pay 2,195 feet, initial production 25 bbls., total depth 2,234 feet. Clyde Bradford's No. 1 Hardege and Wilson, top salt 1,027 feet, top pay 2,317 feet, initial production 30 bbls., total depth 2,475 feet.

Jones County

Ungren and Frazier's No. 1 King, top pay 1,993-2,006 feet, initial production 1,430 bbls., total depth 2,006 feet.

Reagan County

Big Lake Oil Co.'s No. 6-C University, temporarily abandoned location.

WEST TEXAS PRODUCTION
Week Ending May 30

County—	No. wells	Bbls.
Andrews	3	70
Crane	377	18,245
Crockett	51	1,565
Ector	78	7,330
Fisher	11	653
Garza	2	21
Howard-Glasscock	539	30,313
Irion	9	45
Jones	81	1,368
Loving	39	3,605
Mitchell	111	1,932
Pecos	546	74,582
Reagan	255	18,605
Runnels	5	85
Scurry	5	4
Upton	261	5,210
Taylor	3	100
Ward	59	3,469
Winkler	595	45,009
Total production this week		212,181
Total production last week		207,850
Increase		4,331

COMPLETIONS IN PANHANDLE DISTRICT

Carson County

The Texas Company's No. 1 Bednorz, first gas 2,347 feet, big gas 2,630-35 feet,

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WILDCAT OPERATIONS IN WEST TEXAS

Week Ended June 1

ANDREWS COUNTY

Deep Rock Oil Co. et al's No. 1 Kuykendall, 2,310 ft. from N and E of SW cor. Sec. 24, School Blk. A-46. — Remarks: Shut down; total depth 4,648 ft.

BREWSTER COUNTY

Brewster Oil Co.'s No. 1 fee, 2,640 ft. S and 2,598 ft. E of NW cor. Sec. 45, Blk. G-15, G.C.&S.F. Sur. — Shut down 1,935 ft.

R. L. Chapman's No. 1 Skinner, C SW SE Sec. 100, Blk. 3, G.C.&S.F. Sur. — Shut down 1,302 ft.

Trans-Pecos Oil & Gas Co.'s No. 1 Jones, 930 ft. from N and 2,500 ft. from E of Sec. 18, Blk. G-15, G.C.& S.F. Sur. — Shut down 2,820 ft.

Van McPhail's No. 1 McIntyre, SE cor. Sec. 59, Blk. 352, 7 miles S of Alpine — Shut down 1,750 ft.

COKE COUNTY

Reed, Hitchens et al's No. 1 Duncan, 1,980 ft. from S and 1,650 ft. from E of Sec. 239, Blk. 2, H.&T.C. Sur. (4,500-ft. cable test) — Shut down 30 ft.

CONCHO COUNTY

Beesley et al's No. 1 Waring Estate, 400 ft. from N and E Sec. 163, T.&N.O. Sur. — Shut down 267 ft.

Betts & Dennis' No. 1 H. E. Woods, 710 ft. from E and 150 ft. from S Sec. 3, H.E.&W.T. Sur. — Shut down 80 ft.

Turner et al's No. 1 Borsig, 150 ft. from S of NE cor. G. Emmig Sur. 130, 6 miles W of Paint Rock — Shut down 1,850 ft.

CRANE COUNTY

Cranfill Bros. and Gulf's No. 1 J. B. Tubb, 2,310 ft. from N and 330 ft. from E of Sec. 8, Blk. B-27, Public School Land — Total depth 5,336 ft.; plugged back to 4,505 ft.

E. H. Sides and others' No. 1 B. P. Nolen, 150 ft. from S and 150 ft. from W of N 160 acres, Sec. 3, Blk. 31, H.&T.C. Sur. — Drlg. 1,005 ft.; top salt 760 ft.; elev. 2,355 ft.

CROCKETT COUNTY

Doleman & Moore's No. 1 Perner, 3,135 ft. from N and 1,485 ft. from E of Sec. 36, Blk. 2, I.&G.N. Sur. — Spudded and shut down.

CULBERSON COUNTY

Kornrumpf et al's No. 1 Garren, 330 ft. S and W Sec. 15, Blk. 79, Public School Land — Shut down 1,280 ft.

DAWSON COUNTY

Albaugh et al's No. 1 Robinson, C NW Sec. 46, Blk. M, E.L.&R.R. Sur. — Spudded 20 ft. and shut down.

ECTOR COUNTY

Galt, Brown & Penn's No. 1 Cowden, C SE Sec. 12, Blk. 44, Twp. 2s, T.&P. Sur. — Drlg. 3,975 ft.

H. F. Wurts' No. 1 E. A. Ibbetson et al, 330 ft. from N and E lines of NW Sec. 16, Blk. 46, Twp. 3s, G.M. M.Br.&A. Sur. — Cleaning out and reaming 6¾-in. to 8¼ inches 3,257-70 ft.

(Continued on Page 248)

WILDCAT OPERATIONS IN TEXAS PANHANDLE

Week Ending June 1

CARSON COUNTY

Deep Lake Oil Co.'s No. 1 Keys, NE cor. SW, Sec. 1, Blk. 4, L&G.N. Sur. — Remarks: Drlg. 2,000 ft; carrying 8-in. csg.

El Paso-Amarillo O. & G. Co.'s No. 1 Chapman, 594 ft. S, 1,458 ft. E, Sec. 7, Blk. 3, A.B.&M. Sur. — Rig.

Red River Gas Co.'s No. 1-A Bennett, 660 ft. N, 660 ft. W, NW, Sec. 2, Blk. 5, B.&B. Sur. — Rigging up.

CHILDRESS COUNTY

C. L. Sloan et al's No. 1 B. P. Smith, Sec. 49, P. P. Knott lands — T.D. 5,009 ft.

COLLINGSWORTH COUNTY

Dixon et al's No. 1 Bell, 330 ft. N, 1,320 ft. W, Sec. 103, Blk. 21, H.&G.N. Sur. — S.D. 1,993 ft.

COTTLE COUNTY

Darby Oil Co. and Merry Bros. & Perrin's No. 1 Richards, 330 ft. NE, Sec. 13, B.S.&F. Sur. — Drlg. 4,480 ft.

GRAY COUNTY

Anderson et al's No. 2 Vollmert, 330 ft. N and W, SW, Sec. 140, Blk. 3, L&G.N. Sur. — Rig.

Boyles et al's No. 1 Colebank-Morse, 330 ft. NE, Sec. 65, Blk. 25, H.&G.N. Sur. — Spudded and S.D.

Brown et al's No. 1 Duncan, 330 ft. S and E, NW, Sec. 92, Blk. 3, I.&G.N. Sur. — Trying to get on bottom.

Cree Hoover & Traham's No. 1 Delmar, 330 ft. S line, 330 ft. W line, NW, Sec. 105, Blk. 3, L&G.N. Sur. — Standardizing 3,550 ft.

Danciger O. & R. Co.'s No. 1 Barrett, NW cor. S½ NE, Sec. 128, Blk. 3, L&G.N. Sur. — T.D. 3,365 ft; plugged back 3,335 ft; top pay 3,175 ft; swbd. 60 bbls; to shoot.

Danciger O. & R. Co.'s No. 1-B Barrett, SW cor. N½ NE, Sec. 128, Blk. 3, L&G.N. Sur. — Standardizing 3,045 ft.

Danciger O. & R. Co.'s No. 1 Barnett, 231 ft. S, 330 ft. W, E½ of N 56 ac., Sec. 136, Blk. 3, L&G.N. Sur. — 5,000,000 ft. gas 3,097 ft; S.D. 3,120 ft.

Jean Pet. Co.'s No. 1 Furneaux Bros., 330 ft. N and W, cor. SE, Sec. 200, Blk. B-3, H.&G.N. Sur. — S.D. 2,770 ft; P.B. 2,430 ft. and shot with 80 qts. 2,409-30 ft; C.O.

Interstate Prod. Co.'s No. 1 Frazier, C of W 100 ac., of SW, Sec. 177, Blk. 3 — Drlg. 1,950 ft.

Magnolia Pet. Co.'s No. 1 Houston, NE cor. S½ NE, Sec. 164, Blk. 3, L&G.N. Sur. — Cellar.

Nelson et al's No. 1 Crews, 330 ft. S and E, NW, Sec. 13, Blk. 25, H.&G.N. Sur. — S.D. 2,619 ft.

Operators Royalty & Prod. Co.'s No. 2 Vanniman, 330 ft. S and W, E½ NE, Sec. 175, Blk. 3, L&G.N. Sur. — Trying to straighten crooked hole 2,915 ft.

Pulse-Shell Pet. Corp.'s No. 1 Simpson, SE SE, Sec. 140, Blk. 3, L&G.N. Sur. — Location.

(Continued on Page 249)

30 YEARS' *profitable performance protects your* BUCKEYE *investment...*

Only one of many difficult situations handled successfully by Buckeyes.

A Buckeye *Utility* Shovel-Crane helping to lay a line across a dry stream bed in Missouri.

Model 48 Pipe Liner

Largest and most powerful of Buckeye's standard range of heavy duty Pipe Liners is the Model 48. It has the ruggedness, speed and dependability to deliver plenty of completed big trench at exceptionally low cost.

Six standard cutting widths measure 22″ and 24″, 26″ and 30″, and 37″ and 40″, with a maximum trenching depth of 8½′.

Mechanical features that distinguish Model 48, that make it "most satisfactory for pipe line work", include its durable main frame; 95 h.p. industrial type, medium speed gasoline motor; positive acting conveyor, which can be discharged close to the bank or used on either side of the excavating wheel; sturdy digging wheel, double driven with bevel gear differential; multiple, quickly shifted digging speeds ranging from 15″ to 134″ per minute; accurate grading ability; power steering, with lever control; Alligator (crawler) wheels, with provision for safe operation on grades; and efficient one-man control.

Our interesting catalog, "BUCKEYE—*The Pipe Liner*", will be gladly sent to every prospective ditcher owner or user. It contains full data regarding all internationally recognized Buckeye pipe line equipment.

⅜-Yard Shovel-Crane

A handy little full-revolving, convertible unit that offers greater utility on nearly every pipe line construction job. Its very design and build qualify it to give profitable service where heavier, slower and more expensive equipment is impractical because of prohibitive performance and maintenance cost.

Overall height, less boom, 9′ 7″. Overall width, 7′ 5″. Shipping weight, with shovel attachments, 15 tons.

Readily convertible to Shovel, Crane, Backfiller, Dragline and Clamshell service—all as required in a day's operation. Investigate this Buckeye for correct assembly, capacity and price.

THE BUCKEYE TRACTION DITCHER COMPANY, Findlay, Ohio

for over thirty years

Buckeye

THERE'S A BUCKEYE SALES AND SERVICE OFFICE NEAR YOU

Pipe Line Construction News

PIPE LINE PROJECTS IN EAST TEXAS AREA

FORT WORTH, Tex., June 2.—New through pipe line building projects will boost substantially the amount of oil which can be moved out of East Texas fields. Humble Pipe Line Co. is moving in pipe and is starting laying of 10-inch welded pipe looping its present 10-inch Van-Louisiana trunk line from Longview to the Louisiana line from where the Standard Pipe Line Co. will handle the oil. This new line is being laid chiefly to serve the Longview district of Gregg County, and will have a capacity of 30,000 bbls. daily. Humble's 8-inch line from the Kilgore district ties into the Van line at Longview and has taxed that line to capacity making an entrely new line from Longview necessary. Included in this project will be enlargement of pumping facilities at the Longview station and at Marshall. Humble also has started work on expansion of capacity of its 8-inch line from the Joiner district to Groesbeck where it ties into the company's trunk to the coast. Sixty miles of 8-inch pipe have been ordered for this, together with additional pumping equipment. The capacity of this system will be increased 10,000 bbls. to 42,000 bbls.

Magnolia Pipe Line Co. has completed surveys and is letting contracts for the construction of a new 12-inch line to be laid westward out of Kilgore to Corsicana. At the latter point the line will tie into the company's trunk line from Oklahoma and North Texas to the coast at Beaumont. The line will have a capacity of 35,000 bbls. Magnolia already has a 10-inch line in operation out of Gregg County with feeders serving both the Kilgore and the Lathrop Pools. That line, with a capacity of 30,000 bbls. runs eastward to a connection with the company's North Louisiana-Beaumont line at Center Station in Shelby County. These lines make a total outlet capacity of 65,000 bbls. which can be moved to the coast in two directions. In this connection Magnolia is increasing its storage facilities by the erection of three additional 80,000-bbl. tanks at Kilgore and two other eighties at Center. At the latter point the company is negotiating for a 100-acre site for further expansion of tankage facilities.

Atlas Pipe Line Co., now operating an 8-inch line from Longview to Shreveport, is increasing the capacity of the system to 30,000 bbls. daily by the construction of a new pumping station at Marshall. The station will have three units, augmenting the pumping facilities in the field.

Sinclair Texas Pipe Line Co. has started construction of a 12-inch line from Huffman station of the Prairie-Pure Pipe Line Co. Mexia-Smiths Bluff line to the refinery of the Sinclair Refining Co. at Houston. This line, 28 miles long, will run East Texas oil delivered by the Prairie-Pure system to Sinclair at Huffman.

The latest entry into East Texas pipe line building is Shell Pipe Line Co. which is surveying route for a 10-inch line from Gregg County to the refinery of the Shell Petroleum Corp. on the Houston Ship Channel at Deer Park, a distance of approximately 180 miles. This will have a capacity of 30,000 bbls. and will be the second entirely new line to be started from East Texas to the coast, the other

(Continued on Page 248)

SINCLAIR TUNNEL CONTRACT

CHICAGO, June 1.—Subway Engineering Co. of Chicago, has been awarded the contract for the Sinclair pipe line tunnel underneath the Houston Ship Channel at Sinco.

CONTRACT IS AWARDED FOR JACKSON GAS LINE

NEW YORK, June 1.—Ford, Bacon & Davis Construction Corp. has been awarded the contract for expansion of the natural gas system of the Memphis Natural Gas Co. to include Jackson, Covington, Ripley and Brownsville, Tenn.

Construction of the new line has already started, with the Covington extension scheduled for completion by August 1 and the remainder of the line by September 15. The new line will comprise 60 miles of 10-inch pipe, 40 miles of 8-inch pipe and 20 miles of laterals, details of the latter being undecided as yet.

Memphis Natural Gas Co. is a subsidiary of Appalachian Gas Corp. and the Memphis properties are under the operating management of Union Management & Engineering Corp.

The Memphis company owns and operates a 210-mile pipe line, together with two compressor stations and other facilities for the transmission of natural gas, extending from the Monroe Field in Louisiana to Memphis. The entire output is sold under long-term contracts to the Memphis Power & Light Co., Mississippi Power & Light Co., Arkansas Power & Light Co. and the Louisiana Power & Light Co., which are under the supervision of Electric Bond & Share Co. The present extension of Memphis Natural Gas Co.'s pipe line system will serve Tennessee territory through arrangements with the West Tennessee Power & Light Co.

The main line from the Monroe fields to Memphis is of 18-inch pipe, and has transmission capacity of 60,000,000 feet per day. Gas sales by Memphis Natural Gas Co. in 1930 amounted to 9,148,245,400 feet, an increase of more than 45 per cent over the sales for the previous year.

In addition to the main pipe line and the extensions which have just been contracted for, the Memphis company last year acquired from the Mississippi Power & Light Co. 19 miles of pipe line extending to Greenwood, Miss.

COLUMBIA TESTING OLD NEW YORK OIL LINE

NEW YORK, June 1.—Columbia Gas & Electric Corp. is cleaning and testing the old New York Transit Co. oil pipe line from Binghamton, N. Y., to a point near Paterson, N. J., preparatory to the transmission of natural gas to the Paterson industrial area.

According to a company statement no contracts have been taken to supply natural gas to the Paterson area, but the company is getting the line ready. Public Service Corp. of New Jersey, that State's leading utility company, has been soliciting natural gas contracts in the Paterson area for some months, however, and it is expected this company will market for Columbia.

Columbia Gas & Electric Corp. acquired the New York Transit line a few years ago, and is now using a portion of the line between Olean and Binghamton, where natural gas is being distributed through the Keystone Gas Co. of Olean and the Binghamton Gas Works, both of which were recently purchased by Columbia.

The Columbia company has considerable natural gas production in the gas fields in northern Pennsylvania and in the Corning, N. Y., district, and it is now believed the company has developed sufficient production to make feasible extension of its transmission system into the metropolitan New York district.

Another line of the Columbia system, leading from the West Virginia natural gas fields, is now virtually completed, it is reported, and will make natural gas available to the Newark, N. J., industrial area.

MISSOURI-KANSAS LINE REPORTS GAS CONTRACTS

The report of the Missouri-Kansas Pipe Line Co. for the fiscal year ended on March 31 reveals that contracts have been entered into for the sale of gas by the Panhandle Eastern Pipe Line System, jointly controlled by the company and the Columbia Oil & Gasoline Corp., to the Illinois Power & Light Corp., the Missouri Power & Light Co., the Central Illinois Light Co. and the Illinois Power Co.

These companies are subsidiaries of the Commonwealth & Southern Corp. and the North American Light & Power Co., and will acquire the natural gas for the ultimate gas requirements of distribution systems in Champaign, Clinton, Danville, Decatur, Jacksonville, Urbana, Peoria, Pekin and Springfield, Ill., and in certain cities of Missouri, including Jefferson City. In addition, Panhandle Eastern has made contracts with large industries in Kansas, Missouri and Illinois.

The 857-mile main line of the Panhandle Eastern system has been completed to the eastern bank of the Mississippi River from the Texas natural gas fields, and since a certificate of convenience and necessity has been obtained in Illinois, contractors are now laying the main line across this State as well as lateral connecting lines to the communities to be served. The estimated cost of the total system is $40,000,000 By the end of the current year deliveries of gas are expected to begin.

In addition to its half interest in the Panhandle Eastern, the Missouri-Kansas Pipe Line Co. owns through subsidiaries gas reserves in Kentucky and pipe line system in western Kentucky and Indiana, which is being augmented by a new line to Terre Haute and Brazil, Ind., to serve municipalities and industries in that territory.

The consolidated balance sheet as of March 31 shows total assets of $28,008,803, with plant, property, contracts, leaseholds, etc., stated at cost, amounting to $6,139,170. The investment in the Panhandle Eastern Pipe Line Co. is shown as $15,373,566, represented by 15,000 voting-trust certificates for this amount of capital stock.

The balance sheet of the Panhandle Eastern Pipe Line Co. and subsidiaries, as of March 31, shows total assets of $54,930,468, of which current assets and construction funds were $4,302,143. Current liabilities were $3,815,042.

The Kentucky Natural Gas Co., subsidiary of Missouri-Kansas Pipe Line, reports an investment of $2,000,000 in the Terre Haute line and another contemplated investment of $1,500,000 in further expansion in Indiana in 1931. An extension northwest toward the terminus of the Panhandle Eastern system at the Illinois-Indiana boundary is projected.

The consolidated operations of the Missouri-Kansas Pipe Line Co. and its controlled subsidiaries for the year resulted in a net loss of $44,758, after all charges, including depreciation and depletion.

NEW MEXICO PIPE LINE CO.

The New Mexico Pipe Line Co. has taken over the management of the Illinois Pipe Line Co.'s line from the Artesia oil field to Artesia, N. Mex., and the employes of the Illinois line are being transferred to other points of its operation and to activities of the Ohio Oil Co. elsewhere in the Rocky Mountain region. E. H. Perry, superintendent of the Illinois line, and his assistant, Alfred Fox, will remain in Artesia. E. L. Glossner has secured a position at his old home in Crawford, Neb. Pat Moyer and family have returned to Lusk, Wyo.

THREE METHODS OFFERED FOR "SHOOTING RIVERS"

Interesting details concerning problems encountered in the shooting of rivers for pipe line construction are contained in recent reports of the service men of the Du Pont company. With modern equipment, it is now possible to ditch, weld, or screw and lay from 4,000 to 8,000 feet of pipe line a day, and explosives are playing a large part in this operation.

Three systems have been recommended by the Du Pont pipe line service men for the shooting of rivers. In rock, the bottom has to be drilled; in firm mud, a bar can be used; but under water, a pipe and bar should be employed. Where it is necessary to shoot rock in water, gelatin dynamite and electric blasting caps are recommended. Holes are drilled 30 inches apart and 30 inches deep in the solid rock, and a blasting machine and electric blasting caps are employed. In one instance, two sticks of 40 per cent gelatin were loaded in each hole, and 46 holes were shot at one time. It resulted in a 30-inch ditch with plenty of rock for covering.

An especially interesting job was that of crossing Trinity River in East Texas, where government specifications called for the pipe to be laid 4 feet below the river bed. The water at the specified point was 12 feet deep and 200 feet across, and the current was so swift that it was impossible to load through pipes. An unusual method was adopted. A cable was stretched across the line of trench and bundles of five sticks of ditching dynamite were attached end to end on the cable all the way across. Small boulders were attached every 10 feet and the string of dynamite was lowered into place from a raft. The shot resulted in a trench 5 feet deep.

A drop punch earth socket was used to drill the holes in preparation for the blasting of the Colorado River at a point 260 feet wide and 12 feet deep. The river bed was solid shale and the pipe had to be laid 4 feet below the bed level. Casings were set from a raft and the holes were drilled 12 feet deep in the shale and 20 feet apart. Three holes were shot at one time, resulting in a trench in the rock 4½ feet deep at the banks, sloping to 7½ feet in the center.

Other explosives problems encountered in clearing the rights of way over mountains and through swamps are being solved daily by the company's experts.

UNITED GAS SYSTEM GROUPS SUBSIDIARIES

HOUSTON, Tex., June 1.—Another step toward greater centralization of operations of the United Gas System was taken the past week in the liquidation by the United Gas Public Service Co. of its subsidiary, Dixie Gas & Fuel Co. The United Gas Public Service Co. was formed several months ago as the distributing end of the United Gas System and since it has been taking over the various other distributing units under one banner.

The same policy is being followed in the production and pipe line divisions, in which as rapidly as possible all producing subsidiaries are being grouped under the United Production Corp. and pipe line subsidiaries under the United Pipe Line Corp. There will be no important changes in personnel in connection with any of the mergers as generally all the individual companies have the same executive staffs.

The Dixie Gas & Fuel Co. has been distributing gas throughout eastern Texas following the route of the gas transportation system of the Dixie Gulf Gas Co. from which gas is purchased.

LONGER LIFE of Control Equipment results from the use of FISHER Capacity Charts

WHEN you use Fisher Capacity Charts to determine the size of the pressure regulator, liquid level controller, reducing valve, etc. that you require, one result is that you will be assured the maximum life of the specialty. Sounds a bit far-fetched? Perhaps, but it is easily demonstrated.

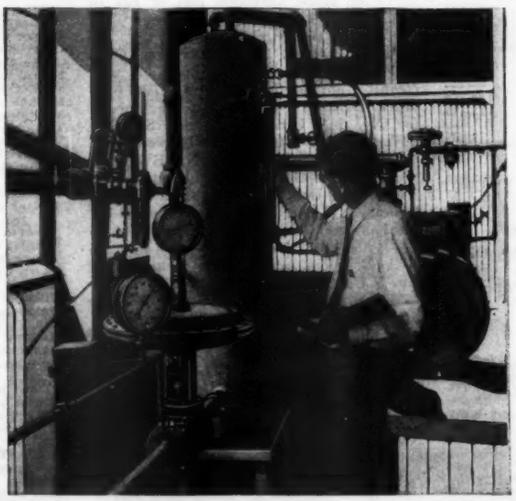
Fisher Capacity Charts are based upon many months of careful testing of every size and type of valve under all conceivable operating conditions. In no sense of the word are they theoretical estimates such as are still widely used. Consequently, these charts permit the selection of a specialty that is known to be correct for the operating conditions and volume requirement . . . . oversizing will be eliminated.

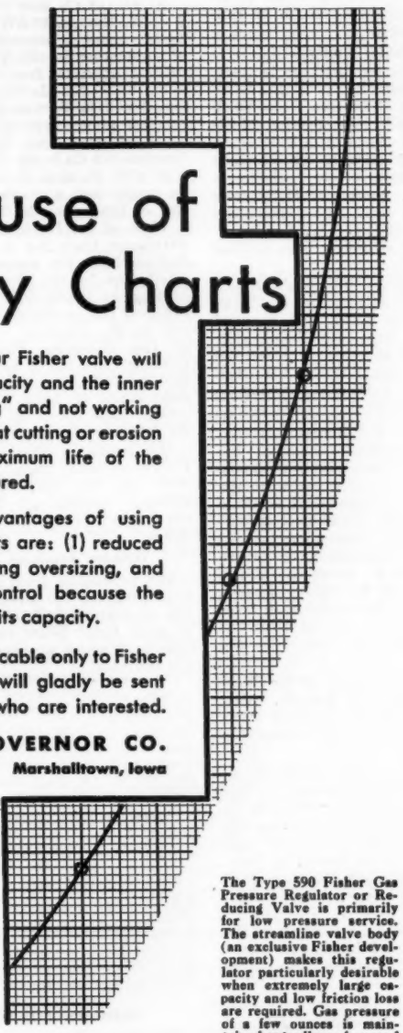
The result is that your Fisher valve will operate near its capacity and the inner valve will be "floating" and not working so close to the seats that cutting or erosion can take place. Maximum life of the specialty is thus assured.

Other important advantages of using Fisher Capacity Charts are: (1) reduced first cost by eliminating oversizing, and (2) more accurate control because the valve is working near its capacity.

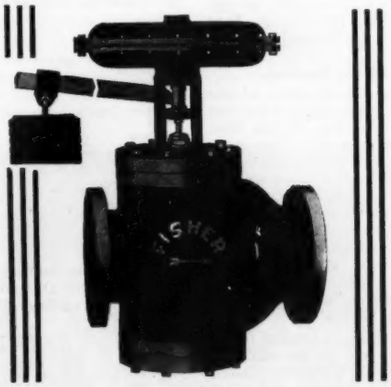
These charts are applicable only to Fisher Specialties and they will gladly be sent upon request to all who are interested.

THE FISHER GOVERNOR CO.
900 Fisher Building Marshalltown, Iowa





The Type 590 Fisher Gas Pressure Regulator or Reducing Valve is primarily for low pressure service. The streamline valve body (an exclusive Fisher development) makes this regulator particularly desirable when extremely large capacity and low friction loss are required. Gas pressure of a few ounces is maintained regardless of normal pressure pulsations on inlet side.



FISHER
THE MARK OF
SCIENTIFIC FLUID CONTROL

OKLAHOMA FIELDS

(Continued From Page 29)

tending south from southern Kansas.

Comar Oil Co.'s No. 1 Babstick, SW cor. SE SE, Section 18-22-5, Pawnee County, was abandoned at a total depth of 3,408 feet in Mississippi lime. The test found a light showing of oil at 3,388 feet and it was believed to be running low on structure.

In Noble County

Another well is expected to be completed in the Magnolia Pool, in Noble County. Magnolia Petroleum Co.'s No. 2 Young, SE cor. SW NW, Section 22-21-2w, is waiting for cement at a total depth of 4,932 feet, and rigging up standard tools. Same company's No. 1 Hoffman, SW cor. SE SE, Section 16-21-2w, was drilling at 4,500 feet. Same company's No. 2 Sumner, SE cor. NW, Section 4-20-1w, southwest of Perry, was drilling at 2,650 feet.

In Kay County, J. S. Pine's No. 2 Ogg, NE cor. SW SE, Section 35-25-1w, near the Tonkawa Field, has resumed drilling at 1,100 feet after being shut down for several months. Boucher Oil Co.'s No. 1 Jefferson, NE cor. SW, Section 32-26-1w, is pulling the casing to abandon at a total depth of 4,634 feet.

Seminole Potentials

Umpire Ray Collins announces the June potentials in the Greater Seminole area and in the other flush fields in the State as follows: The potentials for June on leases in the Allen, (shallow and Wilcox sand), Bowlegs, Carr City (settled production), East Earlsboro, Earlsboro (proper), Earlsboro townsite, Little River, East Little River, Maud, Mission, Sasawka, Searight, Seminole, East Seminole and St. Louis Pools will be determined by deducting 3 per cent from the May potentials.

June potentials for leases in the West Chandler Field, Lincoln County, West Asher-Wanette and West Seminole Pools will remain the same as they were during the month of May.

Class "A" wells in the South Earlsboro Pool were allowed to flow to full capacity June 1, and Class "B" wells on June 2. The total production from the "A" and "B" wells on these dates will be the potentials for the month of June.

Leases in the Wewoka Townsite Pool took a three-hour open flow, from 7 a.m. to 10 a.m., June 1. The production will be multiplied by eight times the amount of oil produced during this period which will be considered the daily potential production.

The flush wells in the Carr City Pool were open to full production for one day from 7 a.m. June 1 to 7 a.m. June 2, which gauge will be considered the potential for the field.

The Konawa Pool was open to full production for one day from 7 a.m. June 2 to 7 a.m. June 3 to determine potentials.

Phillips Leads in Burbank

The daily average production of the Burbank Field in Osage County for the week ending May 30, was 11,495 bbls. from 1,925 producing wells. The daily average from the Burbank extension in Kay County, for the same week was 2,010 bbls. of oil from 196 wells, making a total average production for the entire area 13,505 bbls. The Phillips Petroleum Co. led in producing the largest amount of the oil with a total of 3,724 bbls. a day. The entire Osage County has a daily average production of approximately 32,000 bbls. a day.

A wildcat test in Lincoln County found a showing of black oil in the old Sac and Fox area. Mid-Continent Petroleum Corp.'s No. 1 Lillis, NE cor. SE, Section 9-13-6, found a showing of oil in the top of the Simpson at 4,195 feet. The Wilcox sand was found from 4,250-74 feet with a showing of water. It will probably be drilled deeper.

In the West Chandler area in Lincoln County, Tom Slick Oil Co. and Stanolind Oil & Gas Co.'s No. 2 Kentzelman, SE cor. SW, Section 7-14-4, was shot twice in the Wilcox sand at 4,975-5,004 feet. After the first shot of 20 quarts it flowed 360 bbls. in 10 hours, and after the second shot of 40 quarts it flowed 170 bbls. of oil in 30 minutes.

In Southern Fields

New operations on three tests in the Tatums Field in Carter County were started during the week. All of these operations were on the edge of production and will prove up considerable territory if found productive.

K. D. Oil Co. and Frank Gouin's No. 1 J. W. Burton, C SW NW, Section 30-1s-2w, about a quarter of a mile south of production in the Tatums Field, was drilling at 1,000 feet. Magnolia Petroleum Co.'s No. 1 Wirt Franklin, SW cor. NW NE, Section 15-1s-3w, is a new location about three-quarters of a mile south of production in the field. The Trevlyn Oil Co.'s No. 1 Ratliff, NE cor. NW SW, Section 19-1s-2w, was rigging up rotary tools a quarter of a mile southeast of production in the field.

West of the Healdton Field, Monarch Petroleum Co.'s No. 1 Gregg, SW cor., Section 36-3s-4w, about a mile west of production in the Healdton Field, was drilling at 2,830 feet in shale. It is expected the operators will make a deep test at the location. On the east edge of the Healdton Field, Bunn-Marvin Drilling Co.'s No. 1 Cobb, SE cor. SW, Section 11-3s-4w, was shut down at a total depth of 1,950 feet, after finding several showings of oil in sand at 1,530-40, 1,700-10 and gas at 1,810-20 feet,

Operations in Stephens County were P. Turner and others' No. 1 Andrews, NW cor. SW SW, Section 5-2s-7w, a wildcat, drilling at 2,200 feet. All the operations in the area were shut down.

Greater Seminole Production

The production from the Greater Seminole area for the week ending May 28 was approximately 185,050 bbls. The first 12 pools listed below comprise the Seminole area which averaged approximately 132,163 bbls.

Pool—	Bbls.
Little River	24,792
E. Little River	5,218
Carr City	13,837
Maud	2,493
Mission	8,842
Bowlegs	14,881
Earlsboro	19,342
S. Earlsboro	5,705
E. Earlsboro	17,838
Seminole	13,121
E. Seminole	1,732
Searight	4,312
Total Seminole Field	132,163
Allen	12,120
Asher	662
Wanette	6,899
Konawa	7,381
Sasakwa	2,412
St. Louis-Pearson	22,812
Grand total	185,050

Oklahoma City Shipments

The total shipments from the Oklahoma City Field for the week ending May 30 were 941,792 bbls. The shipments by companies were as follows:

Company—	B'ls.
Champlin	2,953
Empire	187,622
Magnolia	4,631
Oklahoma	117,716
Operators	19,580
Prairie	9,252
Shell	82,026
Sinclair	318,245
Stanolind	146,851
T.T.I.O.	14,969
Tidal	8,489
Anderson-Prichard	5,859
Petroleum P. L.	15,528
Crude P. L.	5,071
Total	941,792

The daily production and pipe line shipments from the Oklahoma City Field for the week ending May 30 were as follows:

Day—	Production	Wells	Shipments
May 24	142,791	85	148,166
May 25	76,244	70	144,367
May 26	133,934	93	141,216
May 27	131,072	89	127,861
May 28	96,919	69	126,357
May 29	124,430	73	125,428
May 30	106,162	66	128,398

Carter County

Magnolia Petroleum Co. is building the rig for No. 1 Wirt Franklin, SW cor. NW NE, Section 15-1s-3w. Trevelyn Oil Co. has the rig up for No. 1 Ratcliff, NE cor. NW SW, Section 19-1s-2w. Amos Drilling Co.'s No. 1 Hooks, SE cor., Section 13-1s-3w, has been completed for 612 bbls. in sands 1,946-2,110 feet.

Beckham County

McFann & Price's No. 1 Webster, C SW SW, Section 34-8-25w, has been completed for 1,500,000 feet of gas in sands, 1,890-1,938 feet, after plugging back from 2,344 feet.

Creek County

Gilcrease Oil Co.'s No. 1-A Lindsley, NE cor., Section 35-17-9, is spudding. J. H. Wright estate's No. 1-A Maloney, SW cor. SE, Section 19-17-11, is rigging. J. H. Winemiller's No. 1 Right of Way, NW cor. NE SW, Section 32-17-12, is rigging up.

Grady County

Margay Oil Co.'s No. 1 Carson, SW cor. NW NW, Section 25-4-8w, has been completed for 1,500,000 feet of gas in sand 1,898-1,918 feet.

Haskell County

Enterprise Gas Co.'s No. 1 McKinney, C SW NE, Section 10-9-18, is drilling at 610 feet. W. L. Bowers Oil & Gas Co.'s No. 1 Kinta, SE cor. SW SW, Section 31-8-20, is drilling at 50 feet.

LeFlore County

Sooner Oil & Gas Co.'s No. 1 Clyman, CSL NE NW, Section 28-7-26, has been completed for 750,000 feet of gas in sand 1,700-1,803 feet.

Lincoln County

T. B. Slick estate's No. 2 Fee, SE cor. SW, Section 7-14-4, has been completed for 835 bbls. in sand 4,975-5,004 feet.

Marshall County

Otto Reynolds' No. 1 Rice, SW cor. SE SE NE, Section 36-5s-5, is dry and abandoned at 350 feet.

McIntosh County

J. S. Routt's No. 2 Eckols, C NW SE, Section 10-11-15, has been completed for 2,000,000 feet of gas in sand 1,034-77 feet.

Muskogee County

C. W. Brown's No. 2-A Smith, SW cor. NE NW SW, Section 14-15-15, is rigging up. Mack Drilling Co.'s No. 6 Richards, SE cor. NE SE NE, Section 33-16-15, has been completed for 7 bbls. in sand 1,240-56 feet. Braman Oil Co.'s No. 5 Jackson, SW cor. SE NW, Section 17-13-16, made 3,000,000 feet of gas in sand 1,080-94 feet.

Okmulgee County

A. W. Cline's No. 8 Harrison, CEL NE SW, Section 19-15-14, is an old well cleaning out to deepen from 1,726 feet. Mack Drilling Co. moved a machine in for No. 1-A Ulrich, NW cor. SW SE SW, Section 30-14-13. Iverson and others' No. 1 Rentie, CNL NE SW, Section 14-14-12, is dry and abandoned at 2,164 feet. Denton & Marshall's No. 1-A Delano, NE cor. NW SE, Section 5-14-14, has been abandoned at 1,708 feet.

Oklahoma County

T. B. Slick estate made location for No. 5 Central, Block 2, Lot 29, Central Addition to Oklahoma City, NW cor. NE SE SE, Section 3-11-3w. The cellar has been dug for No. 1 Curtiss, Block 4, Lot 35, McCornack's Factory Addition, CWL NW SE NW, Section 3-11-3w. Phillips Petroleum Co. made location for No. 1 Chapin-Levi, Block 1, Lots 6 and 7. Chapin-Levi Addition, SE cor. NE NW NW, Section 10-11-3w. H. F. Wilcox Oil & Gas Co., Anderson and Kerr's No. 1 Danforth, NE cor. SE NE SW, Section 15-11-3w, Block 84, Shield's South Oklahoma City Addition, is a cellar. Skelly Oil Co. has the cellar dug for No. 1 Spencer, NE cor. NW SE, Section 15-11-3w, Block 17, Fruitland Addition. Watchorn Oil Co.'s No. 1 Traders Compress, NW cor. SE SE, Section 34-12-3w, has been completed for 8,167 bbls. in four hours from Wilcox sand 6,281-6,440 feet, total depth 6,446 feet. Wirt Franklin Oil Co.'s No. 1 Schilling, CWL NE SE SW, Section 10-11-3w, made 12,271 bbls. in eight hours from Wilcox sand 6,395-6,580 feet total depth. Phillips Petroleum Co.'s No. 1 McBeth, NW cor. SE NE, Section 10-11-3w, was completed for 10,206 bbls. in three hours from Wilcox sand topped at 6,312 feet, total depth 6,411 feet. Indian Territory Illuminating Oil Co. and others' No. 2 Terrace Lawn, SW cor. NE NW NE, Section 10-11-3w, topped Wilcox sand at 6,305 feet, drilled to 6,415 feet and made 8,270 bbls. in four hours. Courter Oil Co.'s No. 1 White, CEL NW SW NW, Section 10-11-3w, flowed 2,291 bbls. in three hours from Wilcox sand topped at 6,435 feet, total depth 6,538 feet.

Pittsburg County

Utilities Production Co.'s No. 3 F. Vail, NW cor. SE SE, Section 8-7-18, is rigging up. No. 2 F. Vail, NE cor. SE SE, Section 8-7-18, has been completed for 10,000,000 feet of gas in sand 1,772-2,056 feet. No. 3 Carney, CNL NE NW, Section 9-7-18, made 11,000,000 feet of gas in sand 1,712-1,970 feet.

Seminole County

Cromwell Oil & Gas Co. and others' No. 2 Dunsem, NW cor. NE, Section 4-9-8, is a cellar. Magnolia Petroleum Co.'s No. 1 Powell, NW cor. SW SE, Section 15-6-7, has been abandoned at 4,634 feet.

Tulsa County

Deems & Bradshaw's No. 1 Grayson, SE cor. NW NE, Section 18-19-14, is drilling at 1,150 feet. Bowder & George's No. 1-A Chisholm, NW cor. NE, Section 5-17-14, is rigging up. Chandler & Day's No. 1 Sheilds, NE cor. SE, Section 20-19-14, is dry and abandoned at 1,339 feet. Owens and others' No. 3 Warner, SW cor. SE SW, Section 33-18-14, made 40 bbls. in sand 1,485-1,550 feet.

NORTH AND WEST TEXAS

(Continued from Page 46)

initial production 16,900,000 feet of gas, total depth 2,700 feet.

Moore County

Gulf Production Co.'s No. 2 Kilgore, top pay 2,890-32 feet, initial production 15,000,000 feet of gas and 385 pounds of rock pressure, total depth 3,300 feet.

NORTH TEXAS PRODUCTION
Week ending May 30

Panhandle District—	Bbls.
Carson County	4,930
Gray County	45,562
Hutchinson County	9,650
Moore County	1,334
Wheeler County	273
Total production this week	61,749
Total production last week	59,002
Increase	2,747
Wichita Falls District—	
Archer County	11,527
Baylor County	461
Clay County	600
Cooke County	1,782
Foard County	52
Jack County	1,901
Haskell County	25
Montague County	3,259
Throckmorton County	319
Wilbarger County	9,763
Wichita County	18,967
Young County	13,296
Total production this week	60,952
Total production last week	61,149
Decrease	197
Ranger District—	
Brown County	3,489
Callahan County	2,543
Coleman County	1,425
Comanche County	720
Palo Pinto County	319
Eastland County	3,081
Shackelford County	3,764
Stephens County	4,410
Total production this week	19,751
Total production last week	19,788
Decrease	37

TRUNK LINE SHIPMENTS

Company, size and location—	Bbls.
Atlantic, 10-inch, Houston	12,694
Gulf, 10-inch, Ranger	24,964
Humble, 2-8-inch, San Angelo	22,926
Humble, 10-12-inch, Comyn	48,737
Illinois, 2-8-inch, Del Rio	26,300
Magnolia, 8-inch, De Leon	18,892
Pasotex, 8-inch, El Paso	7,026
Shell, 10-inch, Healdton	29,242
Shell, 10-inch, Houston	32,331
Texas, 12-inch, Houston	23,549
Total	246,661

RUNS TO WEST TEXAS REFINERIES

Big Spring Ref. Co., Big Spring	913
Burford Ref. Co., Pecos	5,383
Cosden Ref. Co., Big Spring	7,430
Col-Tex Ref. Co., Colorado	9,965
Humble O. & R. Co., McCamey	10,866
Great Western Ref. Co., Big Spring	2,508
Tonkawa Ref. Co., Pyote	1,523
Wickett Ref. Co., Wickett	500
Total	38,887

TANK CAR SHIPMENTS

Shell Pet. Corp. from McCamey	400
Fox and Thorsen from Mertzon	50
Big Lake from Texon	4,000
Southern Crude from Wickett	10,248
Total	14,698
Total daily average production	246,665
Total daily average distribution	200,248
Daily average from storage	32,750

EAST CENTRAL TEXAS

(Continued from Page 45)

it was rumored Shell would lay a line out of the field, but so far that rumor has failed to materialize. However, the company will no doubt go ahead with constructing its first major line out of the district. It now has two loading racks, one serving the Lathrop area and one the Kilgore area, with gathering lines connecting to various leases in these fields.

Extends Rusk Production

Southern Crude Oil Purchasing Co. will complete its first East Texas district producer on its Overton block in Rusk County, in the William Killen Survey, near the Smith County line, extending production over a mile west in this area. It cored 5 feet of sand from 3,758-63 feet and flowed when a drill stem test was made. The well is estimated good for 8,000 or 10,000 bbls. per day. Elevation of the well is 376 feet, making a minus datum of 3,242 feet. It is considered as being near the edge of the producing area, consequently precautions will be taken in completing it, and drilling deeper will not be considered at the present time. Such a move would perhaps be disastrous in the face of what has already been witnessed along the western edge of the Kilgore Pool where several wells made salt water. No indications of water were noticed in this test although it is around 25 feet below the water level. Casing is now being cemented.

Gulf Production Co.'s No. 1 Shepherd in the George Rains Survey, 2 miles east of Selby Oil & Gas Co.'s No. 1 Snavely in Gregg County, extended production and proved more acreage good for production this week when it was completed for an initial production of 60 bbls. per hour through tubing on eleven-sixteenths-inch choke. Oil sand was cored in the test from 3,545,-55 feet, and the initial registered is no doubt but a small percentage of what the well would do on an open flow test in an hour's time.

Neff & Harper and others' No. 1 Cole, in the Samuel Brooks Survey, Gregg County, was another interesting extension this week, adding almost another mile to production when it came in flowing 270 bbls. the first two hours through eleven-sixteenths-inch choke at a total depth of 3,603 feet. Top of sand was logged at 3,558 feet. This is an east offset to Sinclair Oil & Gas Co.'s No. 1 Cole, which burned for eight days before being subdued.

A. M. Griffith's No. 1 Lowe in the Williams Survey, 10 miles southeast of the Joiner Pool, erases more acreage in Rusk County from the possibilities of production as it topped the Georgetown lime at 3,768 feet and was abandoned.

Companies or individual operators continue to seek temporary injunctions against the Railroad Commission to prevent it from prorating their properties, and in retaliation Assistant Attorney General Upchurch continues to file suits in the Travis County District Court against operators in the fields, alleging violation of Article 6,014, Revised Civil Statutes of 1925, governing waste in producing of oil.

COMPLETIONS IN EAST CENTRAL TEXAS

Gregg County

Cranfill & Reynolds' No. 1 S. S. Barton, oil sand 3,695-3,718 feet, initial production 350 bbls. per hour through tubing and casing, total depth 3,718 feet. Corley & Blair's No. 1 W. E. Bumpass, oil sand 3,550-3,580 feet, initial production 408 bbls. first 30 minutes on 1 1/16-inch choke, total depth 3,580 feet. Robert Bowles and others' No. 1 J. C. McKinley, oil sand 3,631-3,662 feet, initial production 180 bbls. per hour on eleven-sixteenths-inch choke, total depth 3,662 feet. Barnsdall Oil Co.'s No. 2 J. G. McGrede, oil sand 3,586-3,614 feet, initial production 108 bbls. on eleven-sixteenths-inch choke, total depth 3,614 feet. Arkansas Fuel Oil Co.'s No. A-2 J. C. McKinley, oil sand 3,575-3,612 feet, initial production 229 bbls. open flow in 15 minutes, total depth 3,612 feet.

Gulf Production Co.'s No. 1 S. S. Fishburn, oil sand 3,554-72 feet, initial production 186 bbls. per hour on eleven-sixteenths-inch choke, total depth 3,572 feet. Heyser-Heard's No. 1 W. J. Guy and C. E. Hineman, oil sand 3,617-47 feet, initial production 98 bbls. on eleven-sixteenths-inch choke, total depth 3,647 feet. Magnolia Petroleum Co.'s No. 2 J. C. McKinley, oil sand 3,629-44 feet, initial production 168 bbls. per hour through tubing, total depth 3,644 feet. O'Brien Brothers' No. 1 J. H. and W. E. M. Haney and others, oil sand 3,496-3,532 feet, initial production 64 bbls. per hour on twenty-sixty-fourths-inch choke, total depth 3,532 feet.

Shano Oil Co.'s No. 1 G. R. Fenton, oil sand 3,606-28 feet, initial production 189 bbls. first hour through 2½-inch tubing, total depth 3,628 feet. Sinclair Oil & Gas Co.'s No. 2 Moncrief, oil sand 3,549-64 feet, initial production 65 bbls. first 15 minutes through 2½-inch tubing, total depth 3,564 feet. Sinclair Oil & Gas Co.'s No. 3 Moncrief, oil sand 3,537-58 feet, initial production 188 bbls. per hour through 2½-inch tubing open, total depth 3,558 feet. Smitherman & Greer's No. 1 Jones and others, oil sand 3,530-75 feet, initial production 152 bbls. in 30 minutes open on 2½-inch tubing and one-fourth-inch line, total depth 3,575 feet.

Stanolind Oil & Gas Co. and Simms Oil Co.'s No. 1 Magrill, oil sand 3,647-68 feet, initial production 160 bbls. through 2½-inch tubing open, total depth 3,677 feet. Yount Lee Oil Co.'s No. 1-B Fenton, oil sand 3,588-3,603 feet, initial production 158 bbls. in 15 minutes open flow, total depth 3,603 feet. Gulf Production Co.'s No. 1 Solon King, top sand 3,570 feet, initial production 113 bbls. per hour through three-fourths-inch tubing choke, total depth 3,593 feet. Magnolia Petroleum Co.'s No. 1 Hughey, top sand 3,503 feet, initial production 127 bbls. in 15 minutes through open tubing, total depth 3,507 feet. Harper & Neff's No. 1 M. T. Cole, top sand 3,558 feet, initial production 500 bbls. in 30 minutes through open casing, total depth 3,603 feet.

Refugio Oil Corp.'s No. 1 Hughey, top sand 3,460-99 feet, initial production 350 bbls. per hour through three-eighths-inch tubing and casing chokes, total depth 3,507 feet. Cranfill Reynolds' No. 1 Scott, top sand 3,565 feet, initial production 240 bbls. in 30 minutes through open tubing, total depth 3,585 feet. Gulf Production Co.'s No. 1 Mary Charles, top sand 3,601 feet, initial production 55 bbls. per hour through three-eighths-inch tubing choke, total depth 3,610 feet. Merren & May's No. 1 Hawkins, top sand 3,647 feet, initial production 130 bbls. per hour through three-eights-inch tubing choke, total depth 3,664 feet.

Sun Oil Co.'s No. 2 J. R. Beall, top sand 3,579 feet, initial production 90 bbls. per hour through three-eighths-inch tubing choke, total depth 3,595 feet. Weaver-Crim's No. 2 Laird, top sand 3,604 feet, initial production 179 bbls. per hour through open tubing, total depth 3,610 feet. Werby's No. 2 King, top sand 3,592 feet, initial production estimated 90 bbls. per hour through three-eighths-inch tubing choke, total depth 3,612 feet. Gulf Production Co.'s No. 3 Spear, top sand 3,605 feet, initial production 130 bbls. per hour through three-fourths-inch tubing choke, total depth 3,618 feet.

Mazda Oil Co.'s No. 1 Hegler, top sand 3,616 feet, initial production 1,000 bbls. per hour through casing and tubing open, total depth 3,641 feet. Pace and others' No. 1 Harrell estate, top sand 3,870 feet, dry and abandoned, total depth 3,870 feet. Rushing's No. 1 J. M. Dickson, top sand 3,572 feet, initial production 1,335 bbls. in 16 hours, 3 hours through three-quarters-inch choke, and 13 hours through ten-sixty-fourths-inch choke, total depth 3,590 feet. C. W. Hindman's No. 1 Blackman, top sand 3,589 feet, initial production 310 bbls. in 15 minutes wide open, total depth 3,610 feet. Paul Vitek and others' No. 1 Louise Osborne, top sand 3,778 feet, dry and abandoned, total depth 4,005 feet.

Rusk County

Arkansas Fuel Oil Co.'s No. 1 John Wheelis, top Pecan Gap 2,700 feet, base Pecan Gap, 3,070 feet, sand 3,631-60 feet, initial production 1,000 bbls. first 11 hours open through tubing, total depth 3,660 feet. Babcock Brothers' No. 2 Camp, top Pecan Gap 2,485 feet, base Pecan Gap 2,985 feet, sand 3,527-40 feet, initial production 50 bbls. per hour swabbing through casing, total depth 3,610 feet. Devonian Oil Co.'s No. 1 Milstead, top Pecan Gap 2,657 feet, base Pecan Gap 3,010 feet, sand 3,628-43 feet, initial production 127 bbls. per hour through tubing, total depth 3,678 feet. Droppleman Drilling Co.'s No. 1 Stone, top Pecan Gap 2,680 feet, base Pecan Gap 3,-110 feet, initial production 440 bbls. first hour through tubing, total depth 3,735 feet.

Foster and Deep Rock Oil Co.'s No. 3 Mayfield-Arnold, top Pecan Gap 2,680 feet, base Pecan Gap 3,048 feet, sand 3,-660-91 feet, initial production 25 bbls. per hour by heads through casing, total depth 3,691 feet. Gilcrease's No. 4 Bradford, top Pecan Gap 2,640 feet, base Pecan Gap 3,045 feet, sand 3,635-56 feet, initial production 110 bbls. per hour through casing, total depth 3,665 feet. Green Pine Oil Co.'s No. 1 Thrash, top Pecan Gap 2,630 feet, base Pecan Gap 2,960 feet, sand 3,595-3,639 feet, initial production 35 bbls. per hour through 1-inch choke on tubing, total depth 3,644 feet. Gulf Production Co.'s No. 3 Thrash, sand 3,705-25 feet, initial production 140 bbls. per hour through tubing, total depth 3,725 feet.

Hefflin and Fox's No. 3 Thrash, top Pecan Gap 2,710 feet, base Pecan Gap 3,075 feet, sand 3,666-99 feet, initial production 400 bbls. per day through tubing, total depth 3,699 feet. Humble Oil & Refining Co.'s No. 6 Kangerga, top Pecan Gap 2,755 feet, base Pecan Gap 3,-154 feet, sand 3,671-3,720 feet, initial production 45 bbls. per hour through eleven-sixteenths-inch choke, total depth 3,720 feet. H. L. Hunt's No. 2 Fair, top Pecan Gap 2,700 feet, base Pecan Gap 3,074 feet, sand 3,645-73 feet, initial production 675 bbls. first 3 hours through tubing, total depth 3,673 feet.

Pace and others' No. 1 Deason, top Pecan Gap 2,647 feet, base Pecan Gap 3,089 feet, initial production 65 bbls. per hour through eleven-sixteenths-inch choke on tubing, total depth 3,704 feet. Pilot Oil Co.'s No. 1 J. E. Thrash, top Pecan Gap 2,719 feet, base Pecan Gap 3,144 feet, sand 3,767-94 feet, initial production 125 bbls. per hour through three-quarters-inch tubing choke, total depth 3,794 feet. Roeser & Pendleton's No. 2 Glenn Pool, top Pecan Gap 2,675 feet, sand 3,672-90 feet, initial production 124 bbls. per hour open through tubing, total depth 3,730 feet.

Turman's No. 2 R. Dark, top Pecan Gap 2,720 feet, base Pecan Gap 3,110 feet, sand 3,675-3,712 feet, initial production 588 bbls. first 12 hours through tubing, total depth 3,712 feet. Vitex's No. 1 Jobe, top Pecan Gap 2,640 feet, base Pecan Gap 3,022 feet, broken sand and shale 3,614-75 feet, initial production 40 bbls. per hour through tubing, total

SAFETY MEN HOLD MEETING IN EAST TEXAS

By L. E. Bredberg

TYLER, Tex., June 1.—The Gulf Coast Chapter, North Texas Chapter and Shreveport-El Dorado Safety Councils sponsored the first safety meeting ever held in the East Texas district when these groups met at the Blackstone Hotel here Friday evening, May 29. D. J. Wallace, safety director of the Mid-Continent Oil & Gas Association, Tulsa, presided.

George Prussing, of the Union Oil Co. of California, and chairman of a subcommittee on fire prevention of the A.P.I., was the chief speaker. He cited the value of fire prevention in fields, how it may best be accomplished, its value to the industry, and described how all fire fighting equipment in the Los Angeles Basin was located so as to be in best position for need for the individual companies, and also how it could all be concentrated for use in fighting one great conflagration, the companies all being ready to cooperate and lend assistance in such a case.

In opening the meeting Mr. Wallace said the East Texas district had already incurred a rather heavy loss of life in the fields, and that the district might easily be the most expensive ever developed because of injuries, and loss of life caused by lack of safety precautions taken at once to keep down injuries. He said it could be made an outstanding field in safety work if the companies and operators would take up safety work immediately and profit by sad experiences witnessed in other boom fields. Co-operation of the companies and operators, and using safety devices and knowledge which is easily obtainable will help to make the district a safer one in which to work, and cut down losses sustained by accidents and deaths.

Joe Risinger, chief of the Gulf Coast Division of the Petroleum Section of the National Safety Council, also spoke on safety work in the East Texas district, and how co-operation of men and companies would help keep down loss of life.

H. N. Blakeslee, safety director of the American Petroleum Institute, Dallas; and C. L. Hightower, safety director of the Texas Pacific Coal & Oil Co., and several other safety department representatives of various companies, cited the benefits to be derived from safety work in the fields. The meeting was attended by 285 men.

depth 3,675 feet. Blackwell Oil & Gas Co.'s No. 1 Moore, top Pecan Gap 2,670 feet, base Pecan Gap 3,100 feet, sand 3,645-63 feet, initial production 300 bbls. per hour through tubing, total depth 3,-663 feet.

Gulf Production Co.'s No. 1 Walter Shaw, top Pecan Gap 2,700 feet, base Pecan Gap 3,108 feet, sand 3,720-32 feet, initial production 115 bbls. per hour through tubing, total depth 3,732 feet. W. B. Hamilton's No. 1 Gambrell, top Pecan Gap 2,640 feet, base Pecan Gap 3,070 feet, sand 3,675-3,711 feet, initial production 260 bbls. per hour through tubing and casing, total depth 3,711 feet. Haynes Brothers' No. 1 Thrash, top Pecan Gap 2,718 feet, base Pecan Gap 3,-153 feet, sand 3,727-74 feet, initial production 330 bbls. per hour open through tubing, total depth 3,774 feet. Humble Oil & Refining Co.'s No. 2 Thompson, top Pecan Gap 2,706 feet, base Pecan Gap 3,086 feet, sand 3,671-3,712 feet, initial production 85 bbls. first hour through eleven-sixteenths-inch choke on tubing, total depth 3,712 feet. H. L. Hunt's No. 1 Plowman, top Pecan Gap 2,800 feet, base Pecan Gap 3,200 feet, sand 3,747-3,843 feet, initial production 3,940 bbls. in 13 hours open through tubing, total depth 3,843 feet.

Hunt's No. 1 M. Pool, top Pecan Gap 2,740 feet, base Pecan Gap 3,145 feet, sand 3,678-95 feet, broken sand and shale 3,695-3,790 feet, initial production 127 bbls. per hour open through tubing, total depth 3,790 feet. Indian States' No. 1 Taliaferro, top Pecan Gap 2,560 feet, base Pecan Gap 3,032 feet, sand 3,634-80 feet, initial production 3,000 bbls. through casing, total depth 3,710 feet. J. E. Mabee's No. 1 Wilson, top Pecan Gap 2,650 feet, base Pecan Gap 2,965 feet, sand 3,647-62 feet, initial production 450 bbls. per hour through casing, total depth 3,662 feet.

W. G. Ray Drilling Co.'s No. 1-A Wilson, top Pacan Gap 2,670 feet, base Pecan Gap 3,032 feet, sand 3,632-57 feet, initial production 175 bbls. first hour open through tubing, total depth 3,657 feet. Roeser & Pendleton's No. 2 M. Pool, top Pecan Gap 2,685 feet, base Pecan Gap 3,080 feet, sand 3,713-22 feet and 3,730-40 feet, initial production 198 bbls. per hour through tubing, total depth 3,745 feet. Devonian Oil Co.'s No. 2 Motley, top sand 3,661 feet, initial production 120 bbls. per hour through three-eights-inch tubing choke, total depth 3,665 feet. Gulf Coast Oil Co.'s No. 4 Brightwell, top sand 3,701 feet, initial production estimated 420 bbls. per hour through open tubing, total depth 3,727 feet.

Snowden McSweeney's No. 3 Ben Laird, top sand 3,560 feet, initial production 170 bbls. through open tubing and casing in 1 hour and 20 minutes, total depth 3,584 feet. Tidal Oil Co.'s No. 1 Laird, top sand 3,681 feet, initial production 75 bbls. in 15 minutes through casing and tubing open, total depth 3,723 feet. Tidal Oil Co.'s No. 1 Terrell, abandoned location. Heep Oil Co.'s No. 1 Givens, top sand 3,620 feet, initial production 120 bbls. per hour through three-fourths-inch tubing choke, total depth 3,625 feet. Humble Oil & Refining Co.'s No. 5-A S. S. Laird, top sand 3,590 feet, initial production 55 bbls. per hour through eleven-sixteenths-inch tubing choke, total depth 3,724 feet. Humble Oil & Refining Co.'s No. 3-B S. S. Laird, top sand 3,576 feet, initial production 48 bbls. per hour through eleven-sixteenths-inch tubing choke, total depth 3,666 feet. Navarro Oil Co.'s No. 3 Brightwell, top sand 3,570 feet, initial production 125 bbls. per hour through tubing open, total depth 3,620 feet.

Republic Production Co.'s No. 1 Bean, top sand 3,578-3,624 feet, initial production 112 bbls. per hour through 1-inch tubing choke, total depth 3,632 feet. Republic Production Co.'s No. 1 Christian, top sand 3,627 feet, initial production 150 bbls. per hour through tubing open, total depth 3,632 feet. Republic Production Co.'s No. 2 Haynes, top sand 3,650 feet, initial production 180 bbls. per hour through tubing open, total depth 3,661 feet. Stanolind Oil & Gas Co.'s No. 1 Brightwell, top sand 3,563 feet, initial production 210 bbls. per hour through tubing open, total depth 3,611 feet. Texas Pacific Coal & Oil Co.'s No. 1 C. O. Christian, top sand 3,718 feet, initial production 270 bbls. in 30 minutes through casing and tubing, total depth 3,750 feet. Turman Oil Co.'s No. 3-B Brightwell, top sand 3,635 feet, initial production 120 bbls. per hour through 1-inch tubing choke, total depth 3,641 feet.

Elsy Drilling Co.'s No. 1 Brightwell, top sand 3,647 feet, initial production estimated 90 bbls. per hour through three-fourths-inch tubing choke, total depth 3,659 feet. Gulf Coast Oil Co.'s No. 3 Brightwell, top sand 3,606 feet, initial production 330 bbls. in 15 minutes wide open, total depth 3,640 feet. E. M. Jones' No. 4-B Crim, initial production 124 bbls. per hour through three-eighths-inch tubing choke, total depth 3,704 feet.

McMahona and others' No. 2 S. S. Laird, top sand 3,635 feet, initial production 650 bbls. in three hours through open tubing, total depth 3,658 feet. Magnolia Petroleum Co.'s No. 2 Birdsong, top sand 3,606 feet, initial production 104 bbls. per hour through three-fourths-inch tubing choke, total depth 3,608 feet. Tidal Oil Co.'s No. 1 J. S. Bean, top sand 3,579 feet, initial production 78 bbls. per hour through three-fourths-inch tubing choke, total depth 3,653 feet. Turman Oil Co.'s No. 4-B Brightwell, top sand 3,642 feet, initial production 176 bbls. in two hours through three-fourths-inch tubing choke, total depth 3,669 feet. Woodley Petroleum Corp.'s No. 2 Thompson, top sand 3,676 feet, initial production estimated 85 bbls. per hour through three-fourths-inch choke, total depth 3,706 feet.

Smith County

Magnolia Petroleum Co.'s No. 1 J. P. Wright, top Pecan Gap 2,670 feet, base Pecan Gap 3,091 feet, sand 3,696-3,701 feet, initial production 115 bbls. first 15 minutes open through casing and tubing, total depth 3,701 feet. Sinclair Oil & Gas Co.'s No. 1-B Jarvis, top Pecan Gap 2,670 feet, base Pecan Gap 3,050 feet, sand 3,648-63 feet, initial production 515 bbls. open through tubing in 4½ hours, total depth 3,663 feet. Witherspoon's No. 1 T. O. Wright, top Pecan Gap 2,675 feet, base Pecan Gap 3,065 feet, sand 3,666-72 feet, initial production 200 bbls. first 30 minutes open through tubing, total depth 3,696 feet.

Chapman and others' No. 1 Alexander, dry and abandoned, total depth 4,115 feet, salt water.

Upshur County

Fleetborn Oil Co.'s No. 1 J. K. Edwards, oil sand 3,589-3,614 feet, initial production 106 bbls. first hour on eleven-sixteenths-inch choke, total depth 3,614 feet.

Anderson County

Humble Oil & Refining Co.'s No. 6-A A. E. Todd, initial production 30 bbls. first hour through eleven-twelfths-inch tubing, total depth 3,673 feet, 700,000 feet of gas.

Cherokee County

O. W. Killam and others' No. 1 W. A. Newton, dry and abandoned, total depth 4,521 feet.

Grimes County

Cullen and others' No. 1 Beckman, dry and abandoned, total depth 2,832 feet.

Van Zandt County

J. C. Fore's No. 1 P. S. Hand, dry and abandoned, total depth 5,160 feet.

Walker County

Texas State Oil Co.'s No. 1 W. L. Fails, dry and abandoned, total depth 3,-204 feet.

Pure Oil Co.'s No. 3 R. C. Crim, initial production on eleven-sixteenths-inch choke 100 bbls., total depth 2,979 feet. Pure Oil Co.'s No. 5 R. L. Wells, initial production on eleven-sixteenths-inch choke, 100 bbls. estimated, total depth 2,924 feet. Pure Oil Co.'s No. 2 A. D. Clark, initial production on eleven-sixteenths-inch choke, estimated 108 bbls., total depth 2,940 feet. Pure Oil Co.'s No. 1 B. W. Russell, initial production on eleven-sixteenths-inch choke estimated 100 bbls., total depth 2,977 feet.

MUST RATED POTENTIAL DEPRESS CRUDE PRICES

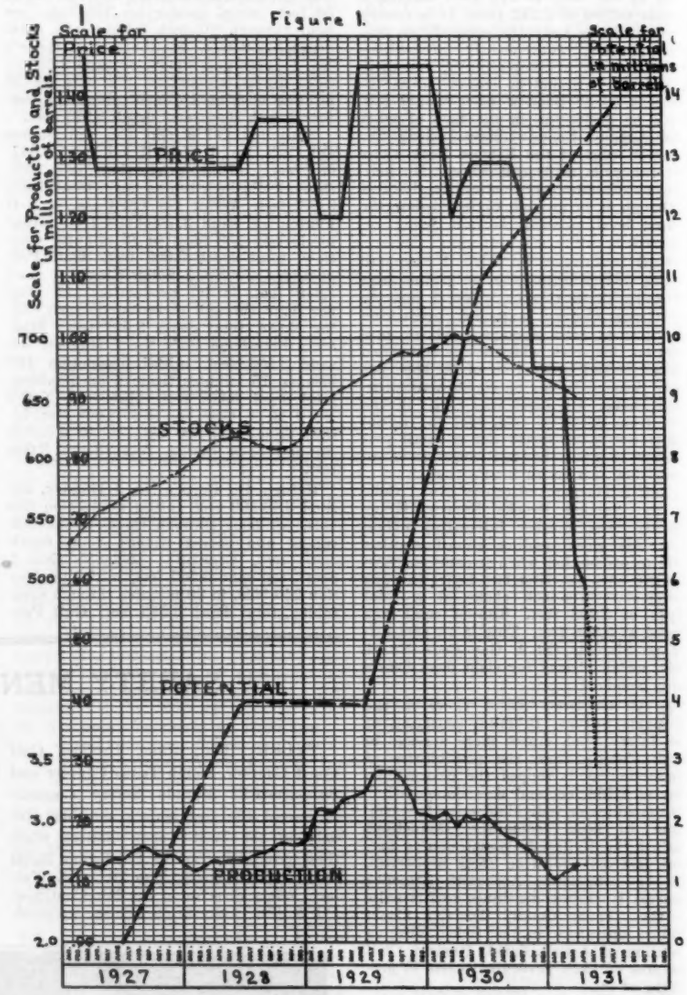
(Continued from Page 19)

The discovery of a new and prolific source should be a profitable success but, if all potential production must be dumped as rapidly as found, there can never be any reserves nor any stability for the industry.

If surplus potential is the strong market depressant it appears to be, and the producer's cognizance of this potential the impelling motive to dump his low-cost flush at any price, the industry should change its mental attitude towards new discoveries. The fields should be considered as so many millions of barrels of reserve supply rather than so many hundred thousand barrels of potential daily production. Short time gauges of high-pressure initial productivity have frequently deceived the industry in the past, and what a well might be able to flow in 24 hours is merely misleading when there is no intention of even building tankage for it to flow 24 hours into.

An equitable and economic method of withdrawing the reserves ratable to meet the market demand at a price entailing a fair profit must be worked out. Present laws may introduce some obstacles, but the prime requisite would seem to be a unified desire within the industry to save itself from destruction.

Figure 1.



REFINERIES IN EAST TEXAS ARE EXPANDING

(Continued from Page 21)

Texas fields is president of the Beacon company.

In addition to the foregoing companies there is a small plant near Arp, Tex., operated by the Independent Oil Co. It is also known as the Boone Refining Co. The plant is said to be running around 200 bbls. daily. The plant is located along a main highway and a service station is operated at the plant site.

Slack Petroleum Co.

The Slack Petroleum Co. of Tulsa expects to have a 2,500-bbl. skimming plant in operation near Longview by the middle of June. This refinery is similar in construction to other small plants in the field and will operate with crude oil obtained from the Longview area.

The Slack Petroleum Co., with offices in the Hunt Building, Tulsa, is owned by Ellis G. Slack. The company in the past has carried on a general brokerage business.

From six weeks to three months have been required to build the plants in the East Texas Field. Several other projects for refinery construction are pending both within and outside the producing area. This includes a couple of plants which are planned for the Gulf Coast area.

ALBERTA WORK COMPLETED

CHATHAM, Ontario, June 1.—James C. Templeton, general manager of the International Geophysical Prospecting Co. of London, England, recently returned to Calgary following a survey of various oil structures in Alberta for British interests. He will leave shortly for England. Dr. Simon Papp, who accompanied him, will remain for several months in Alberta, and will later be joined by a geological party now working in northern India.

EMORY EDWARDS DEAD

TITUSVILLE, Pa., May 30.—Emory A. Edwards, 76, retired oil operator of Titusville, died from the effect of an automobile accident when he was returning from his winter home at St. Petersburg, Fla.

COLD FACTS ABOUT "HOT SPOTS"

* * *

Superintendents know the high cost of "hot spot" repairs. These "hot spots" are caused by corrosion which varies with different soil and water conditions. The economical solution is to balance pipe life by combining in the same line those kinds of pipe best suited for each condition. This is "pipe prescription". It is significant, indeed, that pipe line companies troubled least with "hot spots"

BYERS •GENUINE• WROUGHT-IRON PIPE

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are the most extensive users of Byers Genuine Wrought-Iron Pipe. The explanation is simple: Byers Genuine Wrought-Iron Pipe is the most corrosion resisting of all commercial line pipe materials. What is your corrosion problem? Our engineers will be glad to discuss it with you. A. M. Byers Company, Pittsburgh, Pa. Established 1864.

AN INVESTMENT — NOT AN OUTLAY

GO WHERE THEY A
AND SEE THEM PERFORM

WHEN big engine-compressors are to be bought, there's nothing so convincing as a personal inspection of one or more Cooper-Bessemer powered stations. Probably, you won't have to travel very far—due to the great preponderance of Type-22 installations along the main natural gas lines. See these compressors; read their records; question the station men. Then your decision is easy. Write for a list of standard 1000 B. H. P. installations near you.

THE COOPER-BESSEMER CORPORATION

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BRANCH OFFICES IN ALL PRINCIPAL OIL FIELDS

ARE

When more compressors were needed, Cooper-Bessemers were the logical choice. This Latex station of United Gas Company started with five; now they have eight twin units of 1000 B. H. P. each.

COOPER-BESSEMER TYPE-22's

Good Well in Muskingum County, Ohio

Jackson Township Producer of Pure Oil Co. Is Estimated at 118 Bbls. Eastern Fields Had 26 Completions

By Staff Correspondent

PITTSBURGH, Pa., June 1.—There were 26 completions in the Eastern Fields during the week. The West Virginia Field reported nine gassers and four dry holes, the Pennsylvania Field had one new gasser and the Southeast Ohio Field reported two gassers and four dry holes. This field also has six oil producers with an initial production of 171¼ bbls.

In Muskingum County, Ohio, the Pure Oil Co. brought in a good oil well on the E. J. Hunkins farm in the SE Section 5, Jackson Township. This second test was drilled to 3,210 feet and in the Clinton sand, and its production for the first 24 hours after being shot was 118 bbls. The Day Oil Co. has a combination well in Section 35, Bethel Township, Monroe County. It is a quarter barrel producer and a small gasser from grit at 2,025 feet.

E. R. Edson & Son Co. have had a great deal of success in their shallow sand drilling in the Medina County Field, and during the week furthered their success with the completion of two additional wells. No. 15 on the Archie E. Packard farm, Lot 20, Section 16, Chatham Township, was completed at 365 feet and in Cow Run sand as a 15-bbl. producer, and on the M. A. and Eva Franks farm, Lot 20, Section 16, same township. No. 17 came in as an 18-bbl. producer at 470 feet and in the Buell Run sand. Curtis and Eakin, and Heines and others each got 10-bbl. producers in the same township. Curtis and Eakin's No. 4, on the Thomas Brown, Jr. farm, Lot 22, Section 16, was drilled to 409 feet and in the Cow Run sand, while the second test of Heines and others on the William M. Geisinger farm, Lot 10, Section 9, was completed at 483 feet and in the Buell Run sand.

In Guernsey County, William Urban and others completed their test on the Arthur Davis farm in the Berea sand and at 1,094 feet as a very fair gasser. The Davis farm is in the SW Section 13, Jackson Township. The test of Kelch Brothers on the L. P. Backus farm, Section 35, Brown Township, Vinton County, was completed in grit at 845 feet as a very fair gasser.

Three of the four dry holes reported are in Washington County; the fourth being in Perry County, on the H. E. Stoneburner farm, NW Section 18, Harrison Township, and is the property of David L. Melick, trustee. This drilling operation was ended in the Clinton sand at 3,595 feet. In Salem district, Washington County, R. L. Wright drilled his second test on the John W. Holshu farm on Paw Paw Creek, Lot 146, to 1,154 feet and the Germantown sand, which he found dry, and A. E. Pryor found his test on the C. C. Palmer farm in Lower Salem, Lot 114, to be likewise in the Mitchell sand at a depth of 110 feet. The Robert Biehl farm on Whipple Run, Lot 125, Fearing Township, Washington County, is the location of a dry hole belonging to T. N. Curtis. This well, No. 9, was found dry in a stray sand at a depth of 850 feet.

Drilling in Southeast Ohio

On its way to the Clinton sand, which the operators expect to find around the 2,600-foot level, the deep test of Benedum & Trees Co. in Section 26, Island Township, Jefferson County, on the old Wayne Coal Co. tract, now the property of the Eastern Ohio Development Co., has reached 5,300 feet.

In Muskingum County, the Frits Oil & Gas Co.'s test on the B. F. Floyd farm, Section 3, Brush Creek Township, is shut down at the top of the sand. The Ohio Fuel Supply Co.'s test on the C. H. Harrop farm, Section 5, same township, has been drilled to 1,300 feet. In Clay Township, William Cline and others have constructed a rig at the site of their No. 1 on the Howard H. Doyle farm, Section 3.

The Atha Oil Co. is drilling in its No. 18 on the Melick Brothers farm, Section 21, Madison Township, Perry County, at the 2,900-foot level. The Wehrle Co. has a rig standing on the Wolfe heirs farm, Section 31, Clayton Township, same county, and on the J. A. and W. E. Donnelly farm, Section 1, Jackson Township, there is a rig standing for No. 6 belonging to W. G. Perrigo & Co. In Reading Township and on the Elmer Vansickle farm, Section 5, Bauman and others have constructed a rig.

In Carroll County the following drilling operations are reported: Eaton and others are drilling at the 1,100-foot level in their No. 8 on the Nelson E. Slates farm in Louden Township, and at the 1,200-foot level in their No. 4 on the Jennie Chase property. George W. Elliott and others' No. 3 on the H. G. Buchanan farm has been sunk to 1,250 feet. Drilling operations in No. 4 of the Lisbon Oil & Gas Co. and others on the James M. Hanna property in Center Township have reached 1,200 feet.

The Hilltop Oil & Gas Co. has driven its well on the G. M. Beaver farm in Section 29, Grandview Township, Washington County, down to 1,300 feet.

WEST VIRGINIA

There were no oil producers completed in the West Virginia Field during the week, but on Arnolds Creek in Central district, Doddridge County, Pigott and Son brought in their No. 4 on the J. R. Hiley farm as a small combination well. It was shot at 2,477 feet and in the Big Injun sand. This well is producing at the half-barrel rate from the Gordon sand and as a small gasser from the Big Injun sand.

The Owens-Illinois Glass Co. brought in two fair gassers in Boone County. No. 18 on the Allen Pyror farm, Scott district, was completed at 1,981 feet, and the second test on the J. G. Roberts farm was drilled in at 2,220 feet. The Roberts farm is in Washington district. G. S. Coon has two gassers in his first and second tests on the A. J. Coon farm in Sherman district. The first test was estimated to be a fair gasser four hours after being shot at a depth of 2,178 feet, and the second test is an estimated very fair gasser. This well was completed at 2,185 feet.

The Carnegie Natural Gas Co.'s No. 1,480, on the Whitlach heirs' property in Church district, Wetzel County, was completed as a very light gasser after being driven to 3,314 feet. W. H. Bickel's No. 4 on the J. M. Bennett heirs' farm in Center district, Calhoun County, is a very fair gasser in the Injun sand at 2,076 feet, as is Creed Barker and others' test on the B. R. Holbert farm in Sheridan district, Calhoun County. This well was completed in Salt at 1,675 feet. The test of the Owens-Illinois Glass Co. on the W. R. Parsley farm in Lincoln district, Wayne County, is a fair gasser at 2,590 feet.

In the process of drilling its No. 6,251 deeper, the Hope Natural Gas Co. found the Berea sand dry at 2,420 feet. This well is on the W. V. Gainer farm in DeKalb district, Gilmer County, on Third Run. It was a producer of oil and gas in the Injun sand, and now that it has been found dry will be abandoned. The United Fuel Gas Co.'s No. 4,279 on the Tell McDonald farm, in Center district, Calhoun County, has been found dry.

On the waters of Sheep Run, R. W. Richard completed his test on the School lot in Grant district, Ritchie County, in the Injun sand to find it dry. The J. T. Phillips farm in Washington district, Jackson County, is the location of a test operation of the Pine Knot Oil Co. that was found dry at 2,690 feet and in the Berea sand.

Drilling in West Virginia

In Scott district, Putnam County, H. C. Zogg has chosen a location for his No. 3 on the Maddox heirs' farm, and the Celia Oil & Gas Co. has done likewise for No. 5 on the John Tormey property.

A. E. Ellis and others are drilling in their test on the Harley Gainer farm in DeKalb district, Gilmer County, at the 1,200-foot level. In the same district, Frank Golden and others have constructed a rig on the H. E. Engle heirs' property.

In the process of drilling a test on the Clint Smith farm in Grant district, Ritchie County, Edwin D. C. Lynch has reached 800 feet, and in the same district H. L. Flanigan has a rig standing on the C. F. Batton farm. C. R. Lamp and others have their test on the Ama Dotson farm in Grant district down 2,070 feet. This operation is the deeper drilling on an old well. C. B. Lewis and others have constructed a rig on the W. E. Naker farm, and Godfrey L. Cabot has selected a location on the J. N. Eddy farm in Murphy district.

The C. M. Strickland farm in Sandhill district, Marshall County, is the location of a test by the Myers Oil Co. In the process of drilling a second test on the Reynolds heirs' farm in Eagle district, Harrison County, the Delaware Gas Co. is shut down after having driven the drilling tools to 2,400 feet, and in the drilling of a test on the E. D. Fittro farm in Coal district, the Washington Gas Co. is shut down at 2,374 feet. This test is being drilled deeper.

A report has been received to the effect that S. G. Liming and others have purchased the test of C. E. Goettman on the property of Vandine and others in Big Sandy district, Kanawha County. Mr. Liming has rebuilt the rig at this well and put it to pumping. The result has been production at the rate of 1 bbl. per day.

In Williams district, Wood County, T. J. Rothwell is shut down in his test on the Rebecca Anderson farm after drilling it to a depth of 750 feet, and the test of Love Brothers, on the Daniel Hoover property is in a like condition at 250 feet. Warren Brothers have a rig standing on the J. W. Reed farm, and in Union district, Robert Elder and others have selected a location on the William Wilson farm. Crawley and Carr have also selected a location for a second test on the C. A. Varner farm. The Varner farm is in Williams district. The test on the John Robert farm in Walker district.

(Continued on Page 243)

ECONOMICAL DISPOSAL OF SALT WATER BY USE OF SPRAYING METHOD

By R. E. Ryle
Superintendent, Petroleum Producers Co., Wichita Falls, Tex.*

Every oil producer is frequently confronted with the problem of disposing of salt water. Various methods have been used, principally the salt water pit, which often overflows, resulting in damage and oftentimes a litigation. A company with which I am associated has found the spraying method, outlined below, to be very satisfactory. We have found that from a standpoint of cost the spraying method can be installed much more economically than the building of and maintenance of salt water pits.

Our first spraying system was installed on our L. F. Wilson "E" lease, in Archer County, Texas, in June of 1929, and has operated successfully since that time. We have since installed three additional spraying systems. Before installing a spraying system, you should select a place on the lease that is level and, if the ground will permit, same should be arranged in the form of a square, or rectangle. The latter shape, however, is preferred, for the reason that one feeder line can be used in the system. A good form for spray pit is 140'x 300', with a bar pit 10 feet wide by 2 feet deep around the pit and with all earth from bar pit piled up in a dyke on the outside of the bar pit, with a sump hole in one corner so that the water can be picked up for spraying. This sump should be at the nearest point to your spray pump if the pump is located in the power house on a lease, or at the most convenient place if you use a separate engine for your spray pump.

The most economical hook-up the writer has found is to use the power engine for your power to drive your spray pump, by using a 24"x6" dish-pan pulley on the engine, a 1⅞x5' counter shaft, two 20-inch shaft brackets, one 12"x6" pulley and one 36"x6" pulley, one 3-inch centrifugal pump, all installed in the power house. Three-inch suction line from sump in spray pit and 3-inch discharge line back to spray pit. This discharge line can be bushed down to 2 inches at pit, using a 2-inch feeder line through spray pit. The spacing of the spray heads in the pit are as follows:

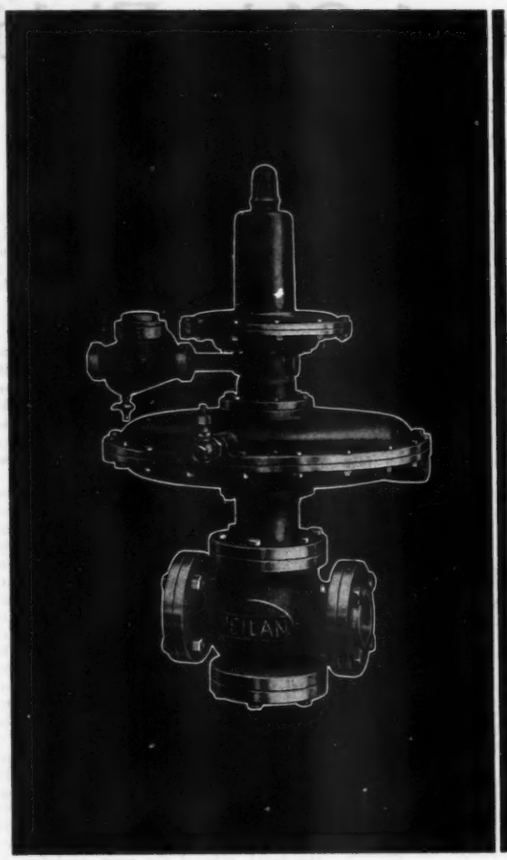
Two-inch feeder line running through center of spray pit lengthwise. Place a 2-inch cross 30 feet from the end of spray pit and then a 2-inch cross every 20 feet. Then use 2"x¾" bushings to bush down for the laterals, using ¾"x10' pieces of pipe for the first section on each side of the 2-inch feeder line, placing the three-quarters-inch tees on the 10-foot lengths and putting in ¾"x20' lengths on farther out with a three-quarters-inch tee at the end of the 20-foot lengths. Leave all tees turned up, so that you can screw spray heads in tees by the use of three-quarters-inch all thread nipples. After this has been completed, run bar pit about half full of salt water, place your belts on and start up. By using the Thompson No. 116 spray head you can adjust your spray to meet your pump pressure to obtain the best results. Also, you can take the No. 116 Thompson apart to clean out the rust, scale, grass roots and weeds that accumulate in the spray heads. The above plan calls for 40 spray heads.

The cost for putting in the above mentioned system less the pit and 3-inch pipe is as follows:

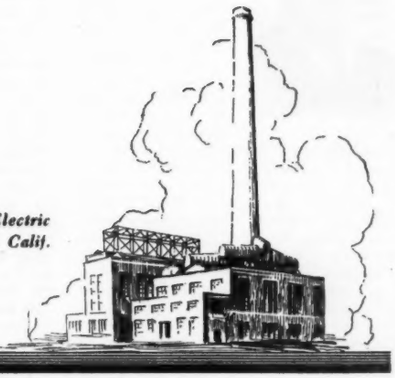
To contract price (Includes furnishing the pulleys, shaft hangers, 3" pump, two 4" belts and the installation of same.)	$215.52
600' ¾" pipe	36.00
10 2" crosses	7.00
40 ¾" tees	5.20
40 ¾" X all thread nipples	2.40
40 No. 116 Thompson spray heads	32.00
Total cost	$298.12

The 3-inch line pipe and connections were not included in this cost sheet as this item will vary according to the location of your spray pit from your power house.

*Before meeting of Wichita Falls, Tex., Chapter A.P.I., Division of Production.



They had to have BETTER REGULATION



75,000 K.W. Turbo-Electric Plant at Seal Beach, Calif.

So they chose NEILAN No 29's

When a Los Angeles Public Utility Company wanted better pressure control of the fuel gas to the 75,000 K.W. Turbo electric plant at Seal Beach — their engineers chose Neilan No. 29's. The constantly varying power load for this service demands exceptionally sensitive reducing regulators capable of instant resetting. Their six large boilers are fired by Neilan Supersensitive Pilot Operated Reducing Regulators which are remotely adjusted to give the desired fuel gas analysis. The result has been increased boiler flexibility and plant efficiency under all load conditions.

Scores of other Neilan 29's are now in service providing constant reduced low pressures. They are successfully solving the problem of providing large and varying volumes of fuel gas to industrial gas fired boilers. For insuring a constant temperature in gas fired crude oil tube stills the Neilan No. 29 is without an equal. The unvarying fuel gas pressure so necessary to batteries of coke ovens is reliably supplied by this advanced Neilan regulator. In other process industries, dependent for efficient operation upon constant low gas pressures, the Neilan No. 29 is meeting with engineering approval. These services include supplying constant gas pressures to drying and baking kilns, heat treating and metallurgical furnaces, glass furnaces and tempering lehrs, and many others.

Through the development of this distinctive new type of pilot operated, pressure loaded diaphragm regulator, Neilan Co., Ltd., has made another worthy contribution to American Industry. If you require constant low gas pressures you will be interested in the service and savings that are yours by using the Neilan No. 29's.

Bulletin cheerfully sent on request.

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YOU CAN BE SURE OF NEILAN PRODUCTS

Ten Completions in Central Ohio Field

Bulk of Development in Old Lima Field for Gas. New Gas Area Opened West of Wood County Field in Henry County

By George A. Whitney
Staff Correspondent, Central West Fields

FINDLAY, Ohio, May 29.—Oil operators are hunting for natural gas more than oil in all divisions of the Central West, the only division passing up the gas is Illinois, where little gas has been found. Central Ohio takes the lead in gas output for the Central West.

In the old Lima Field of northwestern Ohio the bulk of the development work is for gas, although the gas volumes are not what they were in the early days, around 40 years ago. A new gas field has been opened to the west of the old Wood County Field and in Henry County, where fairly good volume is found. In this county, the work of hunting gas is by the Lake Shore and Southwestern Oil & Metal Co., Inc., and the best completion so far made by this company is No. 1 on the E. B. Fiser farm, Section 27, Damascus Township, Henry County, being rated as good for 1,000,000 feet. Same company's No. 1 Nettie McLain farm, Section 12, same township, showed a volume of 500,000 feet, and No. 1 on the W. F. C. McKinney farm, Section 14, same township, had a volume of only 50,000 feet from the Trenton lime. Same company is drilling No. 1 J. E. Hockman farm, Section 23, Damascus Township, and is also drilling No. 1 Francis J. Bell, Section 31, and No. 1 Rachael Van Tassell, Section 22, same township, and No. 1 Frederick Schaffer farm, Section 23, Monroe Township, Henry County.

In the Tiffin Field, the Sandusky Gas Co.'s No. 1 D. S. Hostler farm, Section 3, Hopewell Township, Seneca County, showed 15,000 feet. In this township, J. H. Murphy and others are drilling No. 1 on the H. and C. Shumaker farm, Section 10. J. L. Barrett is drilling No. 1 T. N. Einsel, Section 1, and Clarence Donnels is drilling No. 1 Frank Bosler farm, both in Section 1, same township. In Liberty Township, the Tiffin Industrial Gas Co.'s No. 5 A. Flechner farm, shows 12,000 feet. In Clinton Township, R. B. McKinney and others abandoned old No. 11 William Einsel farm, Section 5, and Arthur Geyer is drilling No. 3 F. E. Baldwin farm, Section 30, same township.

Sugar Creek Oil Co.'s test on the H. Klingbiel farm, Section 24, Harris Township, Ottawa County, and near Elmore, produced 2 bbls. initially.

In Sandusky County, Jackson Township, the Cessna-Fensel, Inc., test on the C. Baker farm, Section 34, was dry. In Rice Township, the Ohio Oil Co. abandoned No. 2 Peter J. Beier farm, Section 4, Rice Township.

Sixteen wells were abandoned in Hancock County. In Liberty Township, the Ohio Oil Co. abandoned No. 3 J. M. Reed, Section 9; No. 10 J. H. Grubb, same section; Nos. 13 and 29 W. C. Watson farm, Sections 9 and 10, and Nos. 4, 12 and 14 Mary A. Reed farm, Section 4. In Portage Township, same county, same company pulled out old Nos. 4, 16, 17, 18 and 21, Section 34, while in Allen Township, same company abandoned No. 8 J. D. Burrell, Section 2; No. 5-A Ephram Trout heirs, Section 14; No. 11 Knoke heirs, Section 23, and No. 3 James Decker fee farm, Section 26.

In Wood County, Montgomery Township, the Ohio Oil Co. abandoned Nos. 2, 4, 5, 6, 7, 8, 9 and 10 S. B. Cessna farm, Section 26, and Donald Oil & Gas Co.'s No. 13 Bloom heirs, Section 16, in Henry Township.

CENTRAL OHIO

There were 10 completions in the Central Ohio Field, of which one was an oil well with an initial production of 9 bbls., one dry hole and eight gas wells, scattered over seven counties. Most of the wells drilling in the large field are for natural gas.

In Ashland County, the only change was the starting of a test by the Commonwealth Gas Corp. on the Ira Witmer, Section 36, Orange Township. Same company is starting a test on the Kent Welsh farm, Section 7, same township. Same concern is drilling No. 4 on the Frank Rhader farm, Section 4, Homer Township, Medina County. McMillan and others are starting a test on the Luke W. Battle farm, Section 3, York Township, also in Medina County.

In Lorain County, Columbia Township, Ohio Fuel Gas Co. has a gas well in No. 1-5,489 A. D. Crocker farm, Lot 90, from the shallow gas sand around 700 feet. Elyria Steel & Tube Co. made a location on the Paulson-Christensen farm, Lot 6, Carlisle Township, same county.

In Ashtabula County, Conneaut Township, the Beeghley-Schaffer Oil & Gas Co. has a fair gas producer in the Clinton from 2,724-50 feet on the Ida Maki farm, Lot 61.

In Coshocton County, Newcastle Township, the Preston Oil Co.'s No. 1-1,480 William Frazee farm, SW, Section 6, produced 9 bbls. initial from 3,180-3,228 feet. F. A. Brendall and others are drilling deeper No. 1 on the E. and C. DeWalt farm, Section 25, Franklin Township, Summitt County.

Licking County

In Licking County the only change is a location has been made by the Wehrle Gas Co. on the Darwin Fidler farm, Lot 26, Bennington Township.

In Muskingum County, the Ohio Fuel Co. has a light gas well in No. 1-5,479 James A. Hale farm, in the second quarter of Falls Township. Whitehill Oil Co. is drilling No. 6 James Boyer farm, Section 6, Hopewell Township.

In Tuscarawas County, Fairfield Township, the Local Oil Co. has a fair gas well in a second test on the J. W. Weaver farm, Section 3, at a total depth of 4,905 feet, the gas being found from 4,874-80 feet.

In Stark County, the East Ohio Gas Co. has a fair gas well on the H. B. Fawcett farm, Section 17, Jackson Township, in the Clinton lime formation from 4,224-49 feet. Same company is drilling on the Elza Hall, Section 13. F. A. Brendall and others have a fair gas well in a second test on the Lake Cable Co.'s land, Section 14, same township, in the Clinton lime from 4,356-84 feet. Medford Oil & Gas Co. has a light gasser in No. 2 John Firestone farm, Section 35, same township, at a total depth of 4,390 feet. Same company is drilling No. 2 John C. Easterday, Section 35, and starting No. 3 same farm and section. East Ohio Gas Co. is starting a test on the Ink heirs farm, Section 30, Plain Township, same county.

In Fairfield County, Berne Township, the City Natural Gas Works' No. 4 Christian Schall, Section 12, is a light Clinton lime gasser at a total depth of 2,462 feet.

In Guernsey County, Center Township, the Center Oil & Gas Co. is drilling on the L. A. Wharton farm, Section 15.

In Belmont County, Union Township, Frank Stranges and others are drilling No. 4 J. H. Barber, Sections 27-33.

Latest report from the wildcat of McClay Brothers, on the M. W. Fram farm, Section 12, Parkman Township, Geauga County, is that the well has reached around 4,000 feet.

F. A. Brendall and others are drilling deeper on the E. and C. Dewalt farm, Section 25, Franklin Township, Summitt County. East Ohio Gas Co. is close to 4,000 feet on the C. C. McCue farm, Section 19, Green Township, same county, and the same company is around 3,000 feet at No. 2 S. and K. Dewalt farm, Section 25, Franklin Township, same county.

Preston Oil Co.'s No. 1-1,482 C. A. Giffin farm, Section 5, Perry Township, Coshocton County, goes into the dry column as the showing was too light to make a commercial producer from 3,244-95 feet, and has been abandoned.

INDIANA

Southern Indiana is looking up like an important oil-producing area, especially the territory in Perry County, where some remarkably fine shallow sand wells are being found near the town of Bristow in the western part of the county. It was in the summer of 1929 that John H. McClurkin worked out a structure 2 miles east of Bristow, Ind., at suggestion of Dr. C. A. Malott of Indiana University at Bloomington, who had run across it a few years previously while working with a corps of geological students during vacation. Mr. McClurkin took up several thousand acres on the best looking part of the structure, later donating 600 acres to Fred I. Conyers of Princeton, Ind., for drilling a test. The test got a small showing in the Jackson sand and a good gas well in the Barlow sand. Before the second well was completed Mr. McClurkin fell ill, had to dispose of his leases and remained in a Louisville hospital all fall, winter and spring of 1929-30, but development work has been steadily carried on by Mr. Conyers. The Ohio Oil Co. drilled three wells near the structure, two being dry and the other a small gas well, all on the south side of the main anticline or "nose" which extends northeast-southwest for 3 or 4 miles, the present production being on the northwest side of the anticline. The first two wells were on the Frank Delaise, SE, Section 25-4s-3w, both being good gas wells; the next four were on the farm of Frank Cassidy, two good gas wells and two oil wells, probably good for 25 bbls. each in NW, Section 30-4s-2w, while the last three were drilled on the farm of Lee Aders in Section 19-4s-2w, Clark Township, Perry County. No. 1 was good for about 25 bbls., while No. 2, which came in about three weeks ago, has been variously rated all the way from 100 to 1,000 bbls., finding its best pay in base of the "Big Lime" of the Owensboro, Ky., Field, and caused a rush to the new field, some of the more prominent Kentucky operators acquiring large blocks of leases, but as the Ohio Oil Co. had previously bought the interests of J. H. McClurkin, whose holdings entirely surrounded the new field, leases could be had only at remote distances from the big well. No. 2 on the Aders found its big pay at 214 feet, and is owned by Fred I. Conyers and others. This company's No. 3 Lee Aders, SE SW, Section 19, Clark Township, has been completed. This well did not make much of a showing in the Big Lime, but drilled to several feet below the Barlow lime, at a depth of 364 feet, began flowing and is now rated much larger than No. 2 and adds considerable to the faith of oil operators in the stability of the new field. No. 3 is estimated as a 350-bbl. producer. The Ohio Oil Co. now has four offsets to drill and probably the best part of the structure remains to be tested. A number of large companies, including the Wood Oil Co., Cumberland Producing Co., Potter Palmer estate of Chicago, Chester Oil Co. of Owensboro, Bailey and others of Sullivan, Ind., and a number of smaller operators and individuals have extensive holdings in the immediate vicinity and several tests are begun or contracted for. Among the local parties interested are Doctor Walters of Tell City and associates who are drilling on the Cassidy

(Continued on Page 291)

WHERE TOOL DRESSER MUST KNOW HOW TO USE AN AX

Not coal or gas, but jack oak, is the fuel used in drilling this water well for the Gulf Pipe Line Co. near Anderson, Mo., so the tool dresser must be able to use a woodsman's ax as well as to wield a sledge. Of course there is no shut-down time for pulling clinkers on this outfit. A threshing machine engine is driving the drilling machine.

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Long and useful life in anything is an indication of satisfactory performance — endurance is proof of quality. The B.S.&B. PERFECTION Vapor Pressure tanks are monuments in themselves to longevity. They not only have years of service to their credit record, but several records of years of service to their credit. These tanks are portable and may be moved from one lease to another or from one location to another in far distant fields. B.S.&B. have branches, and therefore "Service Stations," at or near every proved oil pool in the Mid-Continent and Rocky Mountain fields, with trained erecting crews to erect, take down and re-erect your tanks, thus prolonging their years of service.

B.S.&B. Perfection Vapor Pressure TANKS

These are more than mere ordinary tanks or vats for the storage of crude. These tanks store your crude but also keep it intact, by preventing the escape of the lighter fractions, and thereby maintain the crude at well-head gravity as well as eliminating loss by evaporation.

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Let us prove to you the longevity of the B.S.&B. PERFECTION Vapor Pressure tanks. Let us tell of many instances of the double (or longer) lives these tanks have led, and convince you by actual service of their usefulness and long life. A letter, literature or man will gladly call to tell you more about these tanks. Address Dept. B-47.

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2. The loss of time in refiguring charts for the period.
3. The loss of bronze fittings along the line by amalgamation.
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Natural Gas Industry Developments

Scientific Search For Helium Gas In Southern California

By L. P. Stockman

LOS ANGELES, Calif., May 30.—The attention of naval officials and those interested in the development of lighter than air craft is being drawn to the scientific search for helium gas now under way in the San Fernando Valley in southern California in the hope that a substantial accumulation may be encountered. The present exploration work, conducted under the supervision of Dr. A. F. Mercer, well known geologist and metallurgist, is the result of the accidental discovery of helium gas indications in an oil well being drilled in the vicinity of Reseda, a few miles from Los Angeles, and which was converted into a water well following an unsuccessful production test. Doctor Mercer was called into consultation when it was found that gas in the ditch did not disintegrate, but remained relatively active after standing in mud and water for several days, and was of a quality which would not ignite. This fact, coupled with the unearthing of the upper Cretaceous formation at a shallower depth than it had heretofore been discovered in California, led Doctor Mercer to have tests made which proved that the water which broke in on the production tests made for oil was highly radioactive and contained certain properties known to be present only in certain waters found in Germany. Laboratory analyses made at the laboratories of the California Institute of Technology at Pasadena, under the direction of Dr. C. W. Cartwright, disclosed that the water contained one-tenth of 1 per cent helium gas. Due to a freak formation, originating from an earthquake fault in the Santa Monica Mountains, the gases are believed to have forced their way into the water in search of an outlet.

Doctor Mercer recently traced out this formation from outcroppings in the hills approximately 2,000 feet from the present water well and has worked out what appears to be a well defined structure. The dome, where he believes the greatest concentration of helium gas will be found, is midway between these two points. Indications of an accumulation of helium gas were encountered in the well at a depth of approximately 700 feet, so that this gas may be expected to be encountered on the apex of the dome somewhere around 500 feet. In as much as the one-tenth of 1 per cent found in the water was present because the gas, in seeking an outlet, had forced its way down hill and into the water, it is assumed a much higher percentage of helium will be encountered on the apex of the dome. A new well has just been spudded in on the apex of the structure. Every foot of formation will be checked as the entire area is highly radioactive due to the

(Continued on Page 243)

INCREASE BOW ISLAND STORAGE

CHATHAM, Ontario, May 30.—Announcement has been made by C. J. Yorath, president of the Canadian Western Natural Gas, Light, Heat & Power Co. of Calgary that as a safeguard against possible depletion of the Turner Valley Field, the company is planning to triple the capacity of the repressuring plant at Bow Island. This plant, forcing Turner Valley surplus gas into the Bow Island sands at the rate of 5,000,000 feet a day, has already stored about 1,250,000,000 feet, and with the proposed extension an aggregate of 15,000,000,000 feet will be stored within the next 10 years. Before storage commenced, the gas reserves in the Bow Island sands were estimated at 7,000,000,000 feet.

DEVELOPMENT OF GAS INDUSTRY CHANGES FUNDAMENTAL CHARACTER

By Clifford E. Paige
President American Gas Association*

During the past decade the developments in the field of gas production have changed the fundamental character of the industry. In 1920, 86 per cent of the total gas distributed by manufactured gas companies was produced in their own plants. In 1930, only 57 per cent of the gas distributed by these companies was produced in their own plants and 43 per cent was purchased from sources outside the gas industry, such as steel, coke, chemical and oil companies. In the past two years the amount of gas produced in gas company plants has decreased more than 9 per cent while the amount of gas purchased by gas companies from outside sources has increased 43 per cent.

During the period from 1920 to 1930 there has developed a rapid trend toward the interconnection of the mains of various companies and concentration of gas production in large efficient plants equipped with modern machinery. This development has resulted in the scrapping of many gas-plants in small communities which are now supplied with gas through high pressure gas lines from plants in large cities. This trend toward centralization is indicated by the fact that in 1919 there were 1,300 gas plants in operation in the United States while 10 years later there were only 715, a decrease of 585 plants or 45 per cent.

What is undoubtedly the outstanding feature which has affected the manufactured gas industry in the United States more recently has been development of the newly discovered natural gas reserves, and to a very large degree, the vision and financial backing which made possible long distance transportation.

Less than a decade ago eminent geologists predicted that the oil and gas supply of the United States would soon be exhausted. These predictions have led to greatly increased activities in search for oil which in turn have resulted in the discoveries of many new fields containing enormous quantities of oil and gas.

A few years ago natural gas main lines seldom exceeded 100 miles in length and 14 inches in diameter, but the distance of transmission and the size of pipe lines has progressively increased until now the largest lines are 1,000 miles in length and 26 inches in diameter. The pressure under which the gas is transmitted in these pipe lines has also increased; up until 1926, 350 pounds was considered a very high pressure on natural gas pipe lines; now there are lines operated at 500 pounds and some under contemplation which will operate at 700 pounds pressure.

At the present time, natural gas is the only kind of gas used in six states and it constitutes over 90 per cent of the total gas consumed in 10 additional states; it is marketed in 36 of the 48 states.

The largest new market for natural gas has been in the cities formerly served with manufactured gas. In some of these communities natural gas has completely replaced manufactured gas while in other places it has been mixed with water or coal gas to produce a mixture the thermal content of which lies between 600 and 1,000 B.t.u. per cubic foot. There have also been the communities immediately along, or adjacent to, the new natural gas lines en route to the larger centers of habitation. By means of these extensions, this fuel has been made available in localities which probably might never otherwise have been served.

Replaced by Natural Gas

In the past five years natural gas has replaced manufactured gas in nearly 100 cities and towns ranging in population from 5,000 to 640,000 and over 1,400,000 gas customers have been affected. Such changes create important economic problems.

At the end of the year 1930 the natural gas industry was serving 5,300,000 customers indicating that natural gas is used in the homes of 23,000,000 people. In the year 1930 the amount of natural gas consumed in the United States reached the record figure of 1,940,000,000,000 feet for which consumers paid $415,000,000. Of the total natural gas consumed in the United States domestic or residential consumers use only 19 per cent; 37 per cent is used in drilling oil and gas wells and in other oil field operations, 5 per cent as fuel in petroleum refineries, 14 per cent in the production of carbon black which is so essential to the rubber tire and printing ink industries, 6 per cent in the production of electric power in central station public utility plants and 19 per cent by other classes of industrial customers.

Gas Resources

There is no complete data available on the gas resources of the country but in past years estimates of gas reserves have been made in several gas producing areas and in practically all cases these estimates have been revised upward as time went on because additional drilling of wells, especially those carried to depths of 5,000 to 7,000 feet, have produced gas which was previously undiscovered. In addition, there are potential gas fields in many states where little or no drilling has been attempted. New oil and gas resources are constantly being discovered which assure the natural gas industry of sufficient supply to meet the demands of the potential market.

In the light of this necessarily brief description of the natural gas side of our industry it will be readily perceived that the effects of the introduction of this

(Continued on Page 243)

*Before First International Gas Conference and Sixty-eighth Annual General Meeting, Institution of Gas Engineers, London, England, June 3, 1931.

STANDARD NATURAL GAS CO.

BRADFORD, Pa., May 30.—A new gas company, known as the Standard Natural Gas Co., with a capital of $200,000, has been organized to take over the entire holdings of Claude W. Foster in the Wayne, N. Y., and Nelsonville, Ohio, Fields. The holdings include 5,000 acres and two wells at Nelsonville, and 1,000 acres and interest in wells drilling at Wayne. Three wells will be started at Wayne soon.

The officers of the Standard company are: Michael Murphy, Ellicottville, N. Y., president; A. L. Neuboch, Springville, N. Y., secretary; Claude W. Foster, Bradford, treasurer; Fred J. Carver, Bradford; David F. Black, Olean, and William Stapell, Hamburg, vice presidents; George R. Conquer, Rew, Pa., manager and general field superintendent.

CANADIAN CRUDE TARIFF

CHATHAM, Ontario, May 30.—A recent telegram from Senator Michener to D. Austin Lane, secretary of the Oil and Gas Association of Alberta, indicates that the federal government in its forthcoming budget may impose a tariff on crude oil imports into Canada and increase the present tariff of 2½ cents a gallon on gasoline. There is at present no tariff on imported crude.

REVIEW REFUSED ON FRANCHISE SURRENDER

The Supreme Court of the United States will not review the right of the city of Indianapolis, Ind., to take over the Citizens Gas Co. of that city in accordance with the provisions of a 1905 franchise. The Circuit Court of Appeals for the Seventh Circuit sustained the city's demands to have the company turned over to it and stockholders unsuccessfully sought to obtain a further adjudication by the highest tribunal.

The franchise contract authorized distribution of manufactured gas in the city for 25 years and provided for the retirement of stockholders' rights and the transfer of the plant and property to the city. The stockholders, upon such transfer, were to receive the par value of their shares and 10 per cent per annum.

Following passage of the Shively-Spencer Utility Commission act by the Indiana legislature in 1913, the company filed a declaration of surrender of the 1905 franchise and accepted an indeterminate permit under the act.

The city, in 1929, secured the passage of a legalizing act by the state legislature purporting to legalize the articles of incorporation of companies organized before the 1913 act and to authorize the city to acquire the gas plant without a vote of its people without the authority of the Public Service Commission and relieved of the necessity of paying its "then value as determined by the commission."

The city served on the company a demand to apply earnings and other funds available to the retirement of the common and preferred stock and to convey the plant and property to the city. It also required the company, if the stock had not been retired, to mortgage its plant and after the retirement of the stock, to convey the plant to the city subject to the mortgage and other legal obligations.

GAS UTILITY REVENUES DOWN

Revenues of manufactured and natural gas utilities aggregated $195,496,393 during the first quarter of 1931 compared with $203,576,209 for the first quarter of 1930, a decline of 4 per cent, according to reports from companies serving 13,616,227 customers and representing nearly 90 per cent of the public utility distribution of manufactured and natural gas. The manufactured gas companies reported revenues of $101,674,793, a drop of nearly 2 per cent from a year ago, while revenues of natural gas concerns totaled $93,821,600, or about 6 per cent less than those for the first quarter of 1930. Sales of manufactured gas reported for the quarter totaled 97,385,297,000 feet, a decline of 1.3 per cent, while natural gas utility sales were 210,057,801,000 feet, a drop of nearly 11 per cent. The more pronounced curtailment in natural gas sales was due to the larger proportion of industrial gas business handled by these companies.

CALGARY RATE CASE

CHATHAM, Ontario, May 30.—The Alberta Public Utilities Commission, comprising Judge A. A. Carpenter, chairman; E. J. Fream, commissioner, and Frank P. Fisher of Mount Vernon, Ohio, technical advisor, held a session at Calgary to hear the application of the cities of Calgary and Lethbridge for reduced natural gas rates from the Canadian Western Natural Gas, Light, Heat & Power Co. Expert evidence was given by F. M. Harvey, H. R. Davis, Stanley J. Davies and others for the application and by C. J. Yorath, F. C. Hamilton, Ralph E. Davis of Pittsburgh, Pa.; S. E. Slipper and Dr. J. A. Allan for the company. A decision will be handed down in a few weeks.

Personal Paragraphs About Oil Men

R. D. Aldrich, representing the Ames Specialty Company, Chicago, was in Tulsa for several days.

* * *

William G. DeKoch has been elected chairman of the board of the Cypress Petroleum Company of California.

* * *

Weston Payne, petroleum engineer, has joined the Anderson-Pritchard Oil Corporation at Oklahoma City, Okla.

* * *

B. O. Hammond, Fort Worth, Tex., office of the Parkersburg Rig & Reel Company, made a quick trip to Tulsa by plane last week.

* * *

R. C. Stamets, manager, tubular department, Oil Well Supply Company, Tulsa, made an extended trip into the East Texas territory recently.

* * *

J. V. Schilling, secretary-treasurer of the Cardinal Oil Company, San Angelo, Tex., and Mrs. Schilling have motored to Kansas City, Mo., to spend a vacation.

* * *

John R. Riley and J. J. Fitzpatrick, of the American Iron & Machine Works Company, have just returned from a three weeks' trip through the Gulf Coast territory.

* * *

N. E. Chance, Houston, Tex., district representative of the Brown Instrument Company, has been attending a company conference at Philadelphia, Pa., headquarters of the company.

* * *

W. W. McIlhany, assistant secretary of the California Natural Gasoline Association, has been appointed secretary, succeeding H. W. Parmelee, who recently resigned because of his removal to Montana.

* * *

A. E. Halverson, general sales manager for Imperial Oil, Ltd., and H. R. Knowles, manager of service stations, both of Toronto, are making an official tour of Imperial branches in the Canadian West.

* * *

R. A. Broomfield, president of the Barnsdall Oil Company of California and executive vice president of the Barnsdall Corporation of New York, recently returned to Los Angeles following a trip to East Texas.

* * *

J. J. Murray, marine superintendent of the Associated Oil Company, has been elected a director of the Bilge Club, a marine organization composed of executives and officials of oil companies and marine organizations.

* * *

John R. Lee, vice president, Dodge Motors; John Mack, director of sales, Chrysler Motors, Detroit; and N. C. Seidel, general salesman of the Chrysler Kansas City branch, were Tulsa visitors calling on a number of oil company buyers.

* * *

J. F. Townsend, in charge of the credit department for the Parkersburg Rig & Reel Company, Parkersburg, W. Va., is making a trip through the Mid-Continent area visiting the district offices in Tulsa, Fort Worth, Tex., Shreveport, La., and Houston, Tex.

* * *

D. P. Hartson has been appointed operating manager of the Equitable Gas Company, Pittsburgh, Pa.; J. H. Newlon as superintendent of production and geologist; F. N. Wolf, assistant to the operating manager; J. V. Goodman, as assistant geologist, and G. H. Neilson, Jr., as research engineer.

* * *

A. B. Ryan, who visited Tulsa last week, is now connected with Houston Oil Field Material Company with general offices in Houston, as sales representative in North Texas with offices to be opened at Fort Worth in a few days. Mr. Ryan has been handling sales and credit for Hercules Supply Company, in the general office at Fort Worth for several years.

A. F. Nunes, of Oakland, Calif., has been re-elected president of the Felix Oil Company.

* * *

J. W. Van Dyke, chairman of the board of directors of the Atlantic Refining Company, has sailed for a trip to Europe.

* * *

Frank B. Carr, of the Leland Equipment Company, went to the East Texas oil fields to make a general survey of activities in that area.

* * *

F. W. C. Bailey, Mid-Continent oil field representative, Eagle-Picher Lead Company, has left for a special trip through Texas and Louisiana.

* * *

William R. Bell has recently returned to Tulsa after three years spent with the Burmah Oil Company, Ltd., in the oil fields in Yenangyaung, Valley, Burmah.

* * *

W. A. Pitts, who has been with the Regan Forge & Engineering Company for the past several years in the Mid-Continent territory, is now associated with the American Iron & Machine Works Company as sales representative.

* * *

G. C. McConnell, chief mechanical engineer of the Shell Petroleum Corporation, has been transferred from St. Louis, Mo., to the Tulsa office. He will consolidate the district mechanical engineering offices with Tulsa as headquarters.

Men of the Industry

W. H. Buckley

Superintending the activities of the Arkansas-Louisiana Pipe Line Company is W. H. Buckley, one of the outstanding gas men of the Southwest. In 1901, Mr. Buckley entered the field of general construction and practical engineering. In 1907, he entered the Mississippi A. and M. College, from which he was graduated in 1911 in civil engineering.

Mr. Buckley joined the Arkansas Natural Gas Company in July, 1911, in compressor station construction work and remained in the employ of the company in compressor station and pipe line operation, as well as general construction work.

On January 1, 1929, Mr. Buckley was promoted to general superintendent in charge of all operations. When the Arkansas Natural Gas Company was merged into the Arkansas Natural Gas Corporation in 1928, he became superintendent of the Arkansas-Louisiana Pipe Line Company, a subsidiary which was formed at that time.

Earl W. Sinclair, president of Sinclair Consolidated Oil Corporation, has sailed for a month's vacation abroad.

* * *

D. W. Hovey, manager of the Republic Oil & Refining Company, Houston, Tex., is in Pittsburgh, Pa., on business.

* * *

B. E. Hull, president of the Texas Pipe Line Company, Houston, Tex., has been in New York City several days on business.

* * *

O. E. Daugherty, of Tulsa, was in Casper, Wyo., last week in connection with closing up the affairs of Mammoth Oil Company.

* * *

K. D. Pardee, manager of the northern division, Rocky Mountain region, for the Texas Production Company, is on a short vacation trip to California.

* * *

C. S. Pillsbury, manager of operations, and D. B. Williams, superintendent of southern erection district, Dallas, Tex., both of the Chicago Bridge & Iron Works, visited the Tulsa offices of the company.

* * *

Lawrence Smith, for 18 months assistant superintendent at the Continental Oil Company refinery in Glenrock, Wyo., has been transferred to Lewistown, Mont., where he is being made superintendent of the refinery.

* * *

Frank E. Kistler, of Denver, Colo., founder of the Producers & Refiners Corporation, is now president and general manager of the Greyburg Oil Company and divides his time between New York, Denver and San Antonio, Tex.

* * *

H. J. Morlang, vice president in charge of the midwest division, Oil Well Supply Company, Tulsa, recently spent several days at Pittsburgh, Pa., and also at the Imperial works of the Oil Well Supply Company at Oil City, Pa.

* * *

G. W. Currie, of the International Petroleum Company's staff at Talara, Peru, for the past five years, returned recently to Canada on a four months' furlough. Mrs. Currie and children returned about a month earlier. They will make their home in Sarnia, Ontario.

* * *

H. T. Henton has been made superintendent in charge of production and development for the Ohio Oil Company in the Lance Creek Field, eastern Wyoming, to succeed James Shierry who resigned because of ill health. Mr. Henton's headquarters will be in Lusk, Wyo.

* * *

John D. Clark, formerly president of the Midwest Oil Company, will take the chair of economics at the University of Denver next fall. It is announced that he will build a new home in Cheyenne, Wyo., where the family will reside; he will commute back and forth from Cheyenne to Denver.

* * *

S. S. Nichols, general superintendent of the Texas Construction Company, subsidiary of the United Gas System, Houston, Tex., has been transferred to Montana for an indefinite stay in connection with some special work for the company. V. E. Hamilton, Jr., formerly assistant to Mr. Nichols, has been made acting superintendent at Houston.

* * *

D. C. Shaffer, general manager of the Memphis Natural Gas Company, affiliate of the Appalachian Gas Corporation, with headquarters in Memphis, Tenn., has been elected vice president. Mr. Shaffer, who was born in Williamsport, Pa., has been connected with the natural gas industry for 34 years, beginning with the Buffalo Natural Gas Company in 1897, remaining with this and other Standard Oil properties until 1910, when he joined Columbia Gas & Electric Corporation. He became manager of the Memphis Natural Gas Company on its organization in 1928.

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AS IT DOES TO A

RAILROAD TRAIN

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GUIBERSON

Control Head Packer

Movie cartoons notwithstanding, railroad trains will not climb cliffs, leap chasms and do loop-the-loops as if they had never seen a track. Let a railroad train run off its track and—well, you know what happens. A flowing well running haphazardly through the casing is in the same sad predicament.

The Guiberson Control Head Packer confines the flow to the tubing, insuring maximum flow production by conserving the gas pressure and making it lift oil to the full degree. The need for pumping is postponed. Surface pressure is maintained in the well, preserving the gravity of the oil.

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The Guiberson Tubing Oil Saver set on top of the casing, confines the flow while the Packer is being run. Rubbers permit passage of tubing collars and it can be opened wide to admit Packer or Tubing Catcher. Designed for safety and economy.

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GUIBERSON

BETTER BE SAFE GUIBERSON THAN SORRY

Oil Industry Equipment and Supplies

WROUGHT-IRON WELDING ELBOWS ARE ANNOUNCED

A joint announcement by the Locomotive Terminal Improvement Co., Chicago, and the A. M. Byers Co., Pittsburgh, Pa., wrought iron manufacturers, apparently answers the long felt demand for wrought-iron welding elbows. These new elbows, known as "Weldells," range in size from 2 inches to 12 inches and are manufactured with the same radius and center-to-face measurements as standard radius fittings. In the forging, a tangent is formed on each end, making "Weldells" interchangeable with standard fittings, and the ends are beveled 45 degrees for welding.

Stock sizes include both standard and light-weight (10-gauge) sections. "Weldells" are forged from wrought-iron plate with a smooth, uniform internal diameter and a reinforcing rib along both the outer and inner curvature of radius. The process permits "Weldells" to be made from the same material as the rest of the piping system. Details may be obtained from the Locomotive Terminal Improvement Co., Railway Exchange, Chicago.

BUSINESS NOTES

Goulds Pumps, Inc., Seneca Falls, N. Y., has opened an office in the Magnolia Building, Dallas, Tex., with Fred H. Hayes as manager.

The Hill Clutch Machine & Foundry Co. has moved its New York office from 30 Church Street to 90 West Street. Arthur L. Whiteside is in charge.

The Boston office of the Merco Nordstrom Valve Co. has been moved to 250 Stuart Street to accommodate increased personnel and to provide proper display space for the company's products.

The Dardelet Threadlock Corp. has granted licenses to the Colorado Fuel & Iron Co. for the manufacture and sale of track and commercial bolts and nuts formed with the Dardelet self-locking thread.

The Graver Tank & Manufacturing Corp., East Chicago, Ind., manufacturer of water-treating equipment, tanks, and special plate construction, has appointed the W. B. Conner Co., Chrysler Building, New York, as its eastern representative.

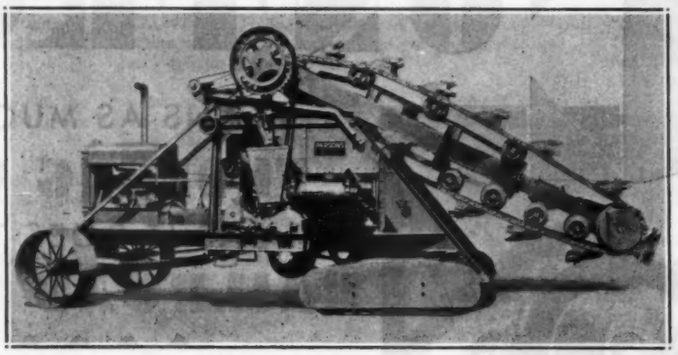
C. F. (Bud) Vincent, formerly stationed in Oklahoma City, is now representing Byron Jackson Co. in the new East Texas Field as sales engineer. Byron M. Landis has been made sales representative for the company in Oklahoma City.

At a meeting of the board of directors of the General Refractories Co., Philadelphia, Pa., Burrows Sloan was elected chairman of the board; John R. Sproul, president; E. A. McKelvy, vice president, and Roger A. Hitchins, secretary and treasurer.

The Dallas office of the Chicago Bridge & Iron Works has moved from the Magnolia Building to the Burt Building. This office, in charge of H. B. Murphey, handles all sales work for the company in the Southwest and erection work in the entire South.

Charles F. Strover, sales manager of the Economy Pump & Oil Tool Co., of Los Angeles, Calif., announces that the concern is to open its own branch office at 230 Center Street, Taft. It will be managed by H. G. Munkhoff and will serve as the headquarters for the district manager, John H. Doane.

IMPROVED PARSONS PIPE LINE TRENCHER ANNOUNCED



The new Parsons Model 35 pipe line trencher embodying basically important features, is announced by National Equipment Corp., Milwaukee, Wis. Providing increased operating speed and efficiency, dependability and long service both in the difficult pipe line and general trench excavating fields, the Model 35 offers several improvements.

The frame has been made 3 feet longer, allowing the introduction of an additional three-speed transmission directly behind the engine, which gives three speed ranges throughout the machine. This feature makes the machine adaptable to every soil condition as any combination of speeds desired in the bucket line, traction and conveyor may be instantly accomplished. The extension of the frame also provides additional counterweight without the addition of dead weight.

Koehring type heavy duty multiplanes having cast steel frames and self-cleaning tumblers have been installed. This multiplane is known for its ruggedness and driving efficiency as the amount of traction power required has been materially reduced.

The conveyor has been equipped with a wider belt and the new design allows an effective dirt-carrying area 6 inches wider than in the old design. The belt is equipped with guide clips that prevent any movement of the belt off center. Cleats are also provided on this belt to prevent any possible slippage of material.

The fuel tank is equipped with a vacuum device by which the tank may be filled from a barrel standing on the ground and preventing spillage of fuel.

The Parsons Model 35 can excavate to a depth of 15 feet and up to 4 feet in width. It is fast in ordinary soils and is particularly well adapted to operate in rough country and in difficult soils including blasted lime rock.

The American Askania Corp., manufacturer of geophysical instruments, Houston, Tex., has opened an office at 1603 South Michigan Avenue, Chicago, with service facilities and displays.

MODEL COMPRESSOR STATIONS ON NATURAL GAS LINE

Following the announcement of a "million-dollar" compressor station at Blackwell, Okla., came news of a similar project at Drumright, Okla. Both stations were designed by the Cities Service Gas Co. and were completed in a remarkably short time. Approximately 175 men were employed in constructing the plant at Blackwell. The layout at Drumright is practically a duplicate.

The buildings were exceptionally well planned and erected—at a minimum of expense, however, for that class of work. Frills and useless material were omitted. Equipment was chosen on the principle that whatever brings efficient operation brings economy, too.

Cooper-Bessemer compressor units at Drumright take gas from the field lines and deliver it into the Cities Service Gas Co.'s main transmission system. Equally large compressor units at Blackwell handle gas from the fields, including the Oklahoma City Field, sending it into the main arterial system of the company. Main trunk lines transport the gas to many cities and towns in Oklahoma, Texas, Kansas, Missouri and Nebraska.

Drumright station has four and Blackwell five 1,000-horsepower, Type 22, twin-tandem, double-acting, gas-engine compressor units. Auxiliary power for each main plant is provided by two 190-horsepower, Type 80 gas engines which direct-drive 120 kilowatts, 150 K.V.A., three-phase, 60-cycle A.C. generators.

The current generated goes to electric motors which drive cooling-water pumps and starting-air compressors. It also furnishes lighting for main and auxiliary buildings, the office and community-club building, the superintendent's cottage and other dwellings. Other facilities in the auxiliary building are boilers for furnishing steam heat; machine shop with lathe, power saw, shaper, drill press and other necessary tools; locker rooms and wash rooms for the station attendants.

HEAT-RESISTING ALLOY STEELS IN MANY FORMS

Stainless low-carbon steels, in a series of varied compositions, are produced in a variety of forms by five subsidiary companies of the United States Steel Corp. and may be obtained either as straight chromium-alloy steels or with the addition of nickel in suitable proportions. In oil refining these stainless and heat-resisting alloy steels are valuable for bubble caps, still tubes, linings, heat exchangers, ducts, containers, tanks, agitators and other refining equipment. They are valuable also in the manufacture of machinery and furnace parts, dampers, fans, preheaters, pumps, conveyors, turbine blades, plungers, airplane parts and instruments, etc.

As a means of designating these products the following symbols have been adopted:

USS 12—Chromium 12-14 per cent.
USS 17—Chromium 16-18 per cent.
USS 27—Chromium 25-30 per cent.
USS 18-8—Chromium 16-20 per cent—Nickel 8-12 per cent.
USS 25-12—Chromium 22-28 per cent—Nickel 12-16 per cent.

Not only do these alloy steels show a remarkable resistance to the action of a wide variety of corrosive agents at moderate temperatures, but they are useful because of their resistance to oxidation at relatively high temperatures.

USS 12 is the only member of the series which may be strengthened by heat treatment. It finds application in pump rods, turbine blades, valves and various machined parts. A special grade, USS 12Z, is prepared for purposes requiring a particularly free-cutting alloy steel.

USS 17 is the leading member of the straight chromium alloy series for general purposes. It is obtainable in practically all forms of semifinished and finished products such as bars, shapes, plates, rounds, sheets, strip, wire and tubing.

USS 27 and USS 25-12 are intended more particularly for use at high temperatures, where they show outstanding resistance to oxidation.

USS 18-8, an austenitic chromium-nickel steel, is the most ductile of all of these alloys and is highly resistant to corrosion. It is useful in so many applications, especially where its deep drawing characteristics are an advantage, that it is one of the best known members of the series. USS 18-8 is produced in the form of bars, plates, rounds, shapes, sheets, tubing, strip and wire. USS 18-12, although similar to USS 18-8 in all of its properties, is designated as a separate grade when a higher nickel content is desired for special purposes.

The United States Steel Corp. subsidiaries referred to, with their products, follow: American Sheet & Tin Plate Co., Pittsburgh, sheets and light plates; American Steel & Wire Co., Chicago, cold rolled strip steel, wire and wire products; Carnegie Steel Co., Pittsburgh, and Illinois Steel Co., Chicago, bars, plates, shapes, special sections and semifinished products; National Tube Co., Pittsburgh, tubes and pipe.

DISTRIBUTOR FOR HYDRAUGER

The Pacific Pipe & Supply Co., Los Angeles, Calif., has obtained exclusive southern California distribution of a new boring tool. The Hydrauger, which is essentially an air motor driven auger, uses water as an aid in making the bore. One of the main achievements of the Hydrauger is its ability to drill horizontally under a street or highway and accurately control the direction of the bore. It obviates the necessity of cutting paving, digging trenches and tunneling.

Technical Questions Answered

BY CHARLES K. FRANCIS, PH.D., TECHNICAL EDITOR

This department of The Oil and Gas Journal is devoted to the manufacturing branches of the oil industry.

Those connected with the refining of crude petroleum, the manufacture of natural gasoline and closely allied industries are invited to submit their problems to Dr. C. K. Francis, technical editor. The department was created for the purpose of aiding managers, superintendents, engineers, chemists and all those engaged in the various phases of plant operation; also those connected with the marketing and utilization of petroleum products.

Questions should be submitted in as much detail as possible so as to assure a satisfactory answer.

All inquiries should be signed and if other than the given initials are to be used please indicate the desired letters.

Questions involving patented processes, intricate formulas and calculations and estimates of costs, for obvious reasons, cannot be answered. The replies will appear on this page within a reasonable time.

ALCOHOL REQUIRED IN MOTOR FUEL

Some years ago considerable was said about the use of alcohol replacing gasoline as a motor fuel and several countries required it to be mixed with all gasoline used in this way. If there are any countries now regulating the use and sale of alcohol in this way I would appreciate such details as you have?—C. H. P.

There are several countries that now have laws and regulations for the use of alcohol as motor fuel, the requirement usually being that some definite percentage of alcohol must be mixed with the gasoline. Extensive details and information on the compulsory adulteration of motor fuel with alcohol has been given by W. Russell in World Petroleum, Volume 2, No. 328, 1931, from which material following has been abstracted. The part of the law relating to alcohol is quoted according to the countries listed.

Germany—The law provides for the compulsory purchase of alcohol at a fixed percentage to a given quantity of motor fuel and fixed this percentage at 2.5 per cent for 1930-31, with 3.5 per cent for 1931-32, and 4 per cent for 1932-33. At present the retail price of this motor alcohol is fixed at 72 cents per gallon.

France—In France the production of the so-called "National Fuel" (Carburant National) has been regulated by law since 1921. Every person importing motor fuel from abroad has to purchase alcohol to the extent of 10 per cent of the quantity of fuel imported and mix it with this fuel.

Sweden—There is no government control. The quantities of alcohol returned as having been sold for motor fuel are as follows for the last three years for which data are available: 1926, 580,000 gallons; 1927, 870,000 gallons; 1928, 660,000 gallons. The retail price of motor alcohol is between 23 and 25 cents per gallon.

Czechoslovakia—The entire amount produced is marketed by a state-controlled organization, which fixes the price and also supervises the production and sale of "Dynalcol." The price of motor alcohol at present is about 20 cents per gallon, which is far below the average cost of production.

Hungary—At present 20 per cent of alcohol is required to be mixed with so-called "medium gasoline," and gasoline of this kind is not permitted to be sold in an unmixed state. The price of motor alcohol is fixed by the government at 23.6 cents per gallon, which is below the production cost.

Italy—The use of alcohol in admixture with gasoline was made compulsory in Italy by a royal decree in 1926, the proportions established being 70 and 30 per cent. Importers of motor fuel are required to purchase a prescribed quantity of alcohol, but owing to the fact that Italy as yet does not produce alcohol in sufficient quantity, the date on which this law was to have taken effect has been postponed.

Brazil—The project, now before the legislatve council, provides that importers of gasoline, before paying the import duties, must show that they have bought "national alcohol" suitable for motor fuel to the amount of at least 5 per cent of the quantity of gasoline imported. This alcohol is required to be mixed with the gasoline according to a table prepared by the government. Until July 1, 1932, the alcohol used may be 96° Gay-Lussac; after that date it must be anhydrous alcohol.

In order further to stimulate the use of alcohol, all motor cars using alcohol-gasoline mixed fuel will be allowed a reduction of 70 per cent in federal, state and municipal taxes, and for three years from July 1 next, denatured alcohol produced in Brazil will be exempt from taxation.

Austria, Poland and Latvia are liable to adopt similar regulations for the use of alcohol according to recent discussions in the respective legislative bodies.

As alcohol (ethyl) must, in most instances be sold below the cost of manufacture, this loss is compensated by higher prices for other uses especially in beverages.

MINERAL SPIRITS FOR THINNING PAINTS

With reference to your reply to J. R. S. in the April 16 issue of The Oil and Gas Journal, probably the specifications used by the American Paint and Varnish Manufacturers' Association would answer the purpose.—F. L. R.

Tentative specifications for volatile mineral spirits for thinning paints and varnishes were adopted by the Federation of Varnish Producing Clubs and American Paint and Varnish Manufacturers' Association, October 25, 1927. These follow:

General—These specifications apply to petroleum distillates known as mineral spirits. The material shall be composed entirely of petroleum distillate and shall conform to the following requirements:

Appearance—Shall be clear and free from suspended matter and water.

Color—Shall be "water white." Not darker than No. 21 on the Saybolt chromometer.

Flashpoint—Shall be no lower than 30° C. (86° F.) when tested in a closed cup tester (such as the Tag closed cup tester).

Odor—Shall not possess a strong or disagreeable odor either when freshly received or after storage.

Distillation test—Distillate below 150° C. (302° F.) shall not exceed 5 per cent. Distillate below 180° C. (356° F.) shall not be less than 45 per cent. Distillate below 220° C. (428° F.) shall not be less than 97 per cent. For method, see A.S.T.M. Tentative Specifications D-86-25-T.

Sulphur—A clean strip of mechanically polished pure 28 gauge sheet copper (approximately one-sixty-fourth inch thick) one-fourth inch in width and 1½ inches in length shall be placed in distillation flask and discoloration noted during distillation as under sulphur (a) and (b).

(a) For varnish thinning, the copper strip shall show no heavy blackening at the end of the distillation though some tarnishing is permissible. The residue of the distillation flask shall be light in color not darker than No. 10 Gardner color standard for varnishes.

(b) For paint thinning, the strip should not be blackened when the temperature in the distillation flask has reached 160° C. (320° F.).

Acidity—The residue after distillation shall be neutral.

Solvent properties—Determination of the relative solvent properties of various mineral spirits may be obtained by the following method:

One hundred grams of carefully selected pulverized kauri gum is dissolved in 500 grams of butyl alcohol 114.4° C. (238° F.) —116.6° C. (242° F.) and heated to the boiling point of the liquid until the kauri is all dissolved. After the flask has been cooled, the additional butyl alcohol is added until the ratio of 100 grams of kauri to 500 grams of butyl alcohol is re-established. The mixture is allowed to stand for 96 hours in a well stoppered bottle when the supernatant liquid is decanted into a clean, dry bottle.

Twenty grams of this mixture is weighed into a flat bottom flask and the volatile solvent to be tested is titrated into the flat bottom flask, keeping the material at exactly 77° F. continuing the addition until the point is reached where a white paper carrying fine black printing is placed beneath the flask and the point is reached where the printing is blurred.

EXPANSION COEFFICIENT FOR HIGH GRAVITIES

I am fully aware of the fixed coefficients for each product, for example, 0.0006 is for petrol, but I have noticed that the oil does not contract or expand immediately the temperature changes. I also give an example when the quantity is converted at 85° (A.P.I.) by applying the fixed coefficient: Stock in the morning 11,009 gallons, at 60° F., converted at 85° is 11,165 gallons; issues 1,200 gallons, at 62° F., converted 1,206; stock end of day 9,798, at 65° F., converted 9,915; converted loss 44 gallons. The stock should have increased to 9,827 gallons. I shall deem it a favor if you will explain.—S. S.

The various national societies concerned with the petroleum industry, together with the United States Bureau of Standards and the Bureau of Mines, have adopted, as standard, a range of coefficients of expansion for petroleum and the liquid products of petroleum. These are:

EXPANSION COEFFICIENTS

Products—	Group	Coef. expan. at 50° F.	Gravity A.P.I. degrees
Crude, fuel, etc.	1	0.0004	Up to 35
Kerosene, etc.	2	0.0005	35-50.9
Gasoline	3	0.0006	51-63.9
First over and N.G.	5	0.0008	79-88.9
Same	6	0.00085	89 and above

Groups 5 and 6 should be used for the most volatile fractions obtained from petroleum and such products as natural gasoline. No careful analysis of the example as given has been made, because it is clear that the correct coefficient has not been used. Evidently there must be a combination of errors. There should be no correction of the first volume, because the volume was determined at 60° F. While the table is based on A.P.I. degrees, modulus 141.5, it may be used when the hydrometer is graduated on the Baume scale for liquids lighter than water. The corrected volume for 1,200 gallons at 62° F. to 60° F. is 1,197.88 or 1,198, so this leaves 9,802 as the remaining quantity. This is reported 9,798 at 65° F., but should be 9,841 gallons; that is 9,802 + (9,802 × .0008 × 5) = 39.2 gallons. If the gauge of 9,798 at 65° F. was correct, the handling loss was 43 gallons.

Convenient tables for correcting volumes at various temperatures and other related information may be found in the National Standard Petroleum Tables, Cir. Bureau of Standards No. 154, obtainable from the Superintendent of Documents, Washington, D. C., for 50 cents. See also Bureau of Standards, letter circular 160.

KNOCK RATING CONVERSION CHART

We find that many of the oil companies have different methods of speaking of the knock rating of gasoline, and it would be much appreciated if you could refer the writer to a chart that combines the different formulas so that if one company spoke of gasoline of a certain octane number or used the ethyl secondary standard, benzol equivalent, or the Midgley bouncing pin method, you could by referring to the chart determine the various comparative ratings. Please advise. —A. R. F.

It is not possible to reduce knock ratings of gasoline, as made by various refiners or when stated in several different terms to a common or uniform standard. Any two forms may be compared. The character of the crude oils, their composition, as produced in the different districts, is known to be reflected in the knock rating of the gasoline that may be made from them. Methods of separation, such as topping or kind of cracking, and the treating process, may also affect the resulting gasoline as to the tendency to cause a knock when used as motor fuel.

The numerous methods that have been proposed for expressing knock rating have in many instances certain objectionable features. This may be illustrated by reference to benzol equivalent, one of the first standards to be suggested. A knock rating of 40 per cent benzol meant that the gasoline knocked to the same extent as Pennsylvania straightrun gasoline to which benzol in the proportion of 40 per cent by volume had been added. It is not a difficult matter to obtain benzol of definite purity but it was soon discovered that all Pennsylvania gasoline was not alike. Also it is not feasible to make a selection of a large quantity of this kind of gasoline, bring it to some fixed specification, then distribute it around the country as would be necessary if it were universally accepted as the standard medium for blending with benzol.

When all conditions are under control, such as in a definite refinery, it is possible for the chemists to arrange tables and charts for the conversion of one form of knock rating into some other. Data of this sort have no value in another locality where entirely different conditions have to be recognized.

Octane number, as proposed by Dr. Graham Edgar, seems to take care of the objections made to other units. The required hydrocarbons may be obtained in a pure condition and will give reproducible results when the test is made in widely separated parts of the country by different chemists.

According to a recent survey of the United States Bureau of Mines, the competitive gasolines range from 51 to 66 in octane number. The premium gasolines were found to vary between 65 and 80 octane number with an average of 73.7 octane number. See The Oil and Gas Journal, April 23, 1931, page 79; April 30, 1931, page 22.

Frank Kirk Didn't Like Fixed Address

So He Used to Make His Own as Temporary as Possible, but in That Way He Acquired Many Kinds of Oil-Field Experience

By Thomas F. Smiley

For a long time Franklin W. Kirk, now general manager of the Houston Pipe Line Co., entertained a profound aversion toward permanent addresses and he refused to be bothered with one. It would only get in the way. You couldn't pawn it in case you were broke. It enabled life insurance men and book agents to find you easily. It had a marked tendency to keep you tied down to one spot. So Mr. Kirk strove earnestly, enthusiastically and with a gratifying degree of success to make his addresses just as temporary as possible. But while he leaped in his carefree way from one address to another he was accumulating a tremendous amount of experience in many sorts of oil jobs, with the result that when he eventually decided to pick out a good, reliable address and keep it he had an oil field background calculated to make him master of just about any situation he was likely to encounter as a pipe line company executive.

Mr. Kirk's antipathy for fixed places of abode manifested itself early, for although the family resided in Wilmington, Ohio, he was born in Logansport, Ind., on the occasion of a maternal visit to that city. Wilmington was really his home town of course—"on the right-hand side of the B. & O. tracks," Mr. Kirk particularizes. He attended the grade schools of the village and then—like his father, Jonathan Kirk, and his grandfather, James Kirk, before him—went to the Friends Academy, a Quaker institution which later became Wilmington College. For a time too he attended the St. Pierre de Lac St. John School in the province of Quebec, Canada. This came about through his mother having come from Quebec. Then the boy took a course in mechanical engineering at Perdue University, Lafayette, Ind.

From School to Oil Lease

In vacations young Frank worked on oil leases owned by relatives in the Oil City and Bradford districts of Pennsylvania. When his schooldays were over he held various oil field jobs in Pennsylvania, northern Ohio and Indiana. At this period he worked under the late Daniel O'Day, vice president of the National Transit Co., and in charge of all the Standard Oil Co.'s pipe lines. He also worked under the late Sam Murdock, who had varied natural gas interests, and the Neely brothers, J. D. S., and Len, who owned large natural gas properties with headquarters in Lima, Ohio.

Frank's first work was as a pipe liner and then he became a pumper, a tool-dresser and a driller. His jobs kept him darting about Pennsylvania, Ohio, Indiana and West Virginia, and he often had difficulty in finding freight trains that would convey him to the next town of his selection. Permanent addresses seem to have been peculiarly repugnant to him at this time. In 1888-1889 he helped to build a natural gas line from Madison County, Indiana, to Chicago. His help consisted in keeping the lead in the melting pot hot for making tight joints. Incidentally the field played out later and Chicago had to give up natural gas as a fuel.

Although the histories, perhaps because they were cramped for space, have failed to mention Frank's name, it should be recorded here that he helped to smash Admiral Cervera's fleet at Santiago Harbor in the Spanish-American War. When the war broke out in 1898 Frank tried to get into infantry regiments in Ohio and Indiana, but the recruiting officers always rejected him because of his height, 5 feet 5¼ inches. Being told that the Michigan Naval Reserves were likely to get into active service, he tried his luck with that organization and he was accepted as a fireman of the first class. To remove any misconception concerning the duties involved Mr. Kirk explains that a fireman in the naval service shovels coal, adding, "and I made a damned good coal shoveler."

Then Came the Shooting

The information which had moved Frank to enlist in the Michigan outfit proved good and before long he was in West Indian waters feeding coal into the boilers of the gunboat Marietta. During the battle of Santiago Harbor one of the officers of the Marietta stood on the grating that covered the companionway leading to the firehold. Peering up through the grating Frank was fascinated by the officer's feet, which he declares "must have been the biggest in the United States Navy."

Every little while Big Feet, making a megaphone of his hands and bending close to the grating, would shout down the companionway for the inspiration of the sweating stokers, "Just sunk another one!" After this encouraging report had been bellowed 26 times Frank quit keeping score, figuring there couldn't be much left of the Spanish fleet anyway. He was astonished later upon finding out that only 13 ships had been sunk or grounded. The Marietta was struck by an enemy shell and several men were injured, none fatally.

In 1901 Frank went to Independence, Kans., and took part in the early oil development there. For about two years he worked as a tool-dresser for the New York Oil & Gas Co., an R. M. Snyder organization which formed the nucleus for the Kansas Natural Gas Co., afterward taken over by the Cities Service Co. For the next three years he was with the Wichita Natural Gas Co. as a pipe line foreman. This company also was taken over by Cities Service.

Following organization of the Lone Star Gas Co., Frank went to Texas in 1909 and was general pipe line foreman for that company till 1918. Ill health compelled him to drop out of active work for a short time, after which he helped in the construction of the Government's helium plant near Fort Worth, later abandoned.

Investigating Oil Properties

The next few years were devoted to following oil booms in various places, investigating the conditions and then making reports on oil properties for financial interests in the East with which he had become associated. Mr. Kirk became especially proficient in this kind of work and it carried him to oil areas in Kansas, to the Ranger and Desdemona fields in Texas and eventually to Mexico and South America. Following this he was engaged to go to Italy, France and England to investigate oil market possibilities in those countries.

From 1922 to 1925 Mr. Kirk served as a sort of general utility man under F. M. Lege, vice president of the Magnolia Petroleum Co. in charge of natural gas production, and made president of the Magnolia Gas Co. when that company was organized. Mr. Kirk directed pipe line construction and took care of other work in the field during this time.

In 1925 the Houston Pipe Line Co. was organized as a subsidiary of the Houston Oil Co., to handle the natural gas properties of the parent organization and Mr. Kirk was made general superintendent. His first work was to direct the construction and operation of lines from Live Oak County into Houston, Tex. He continued as general superintendent until July, 1929, when upon the death of Charles B. McKinney he succeeded Mr. McKinney as general manager.

When the Houston Pipe Line Co. was constructing its main line from Live Oak County it was beset by troubles, including a hard-boiled ranchman near Wharton, who did his utmost to obstruct the company in laying pipe across his property. After the surveyors had completed their task with much difficulty the ranchman made the cheering announcement to Mr. Kirk and a group of workmen that the first pipe line man who entered upon the property would be perforated with a 30-30. He cursed the company as a corporation and then addressed himself to its officers, directors and employes as individuals. His oaths were shocking and savage, but they lacked originality and imagination.

Aw, Let a Man Swear Who Knows How

Frank listened, first with impatience and then with the sorrow that crude work excites in the breast of a finished craftsman. He had learned the art of swearing in the school of the pipe line construction camp and when he believed the occasion demanded profanity he was able to deliver it. So when the ranchman paused for breath Frank started in, conservatively at first, but his madedictions growing in scope and intensity as he continued. He hurled strange and blistering anathemas at the awed ranchman. They stung and bit and left the listener gasping. The ranchman's raw blasphemy became flat and meaningless by comparison.

The ranchman wilted under the hot stream of imprecation. He realized that he stood in the presence of a master. Approaching Frank he said admiringly, "Say, maybe you can't cuss." Frank bestowed upon the other a glance that meant, "Oh, that's nothing. You ought to hear me when I'm going right."

After a long and curious look at the pipe line man the ranchman asked, "Say, d'ye want a new hat?"

"Sure," grinned Frank.

"C'mon," directed the other. And they went to a store in Wharton, where the ranchman told a salesman, "Say, give this fellow the best geedee hat you've got in the place. I thought I could cuss, but you ought to hear him!"

Frank went out wearing a $10 Stetson.

In one other encounter with a recalcitrant property owner Mr. Kirk admits he did not emerge so triumphantly. It was back while he was a pipe line foreman for the Wichita Natural Gas Co. A. P. McBride was president of the company, which had leases around Independence. A dry hole had been drilled on one of these leases and the casing had been pulled. Frank went out to attend to having the casing hauled away. The farmer who owned the land ordered

(Continued on Page 243)

SWIFTLY BECOME LEGENDARY FIGURES

Frank Kirk worked under Dan O'Day and Sam Murdock and the Neelys. To many a middle-aged man now in the thick of oil and gas activities those names stir a host of memories. To thousands of the younger men, into whose hands the destinies of a giant industry soon must be committed, the names have a vague and shadowy import. How swiftly the active, aggressive leaders of today fade into legendary figures of yesterday.

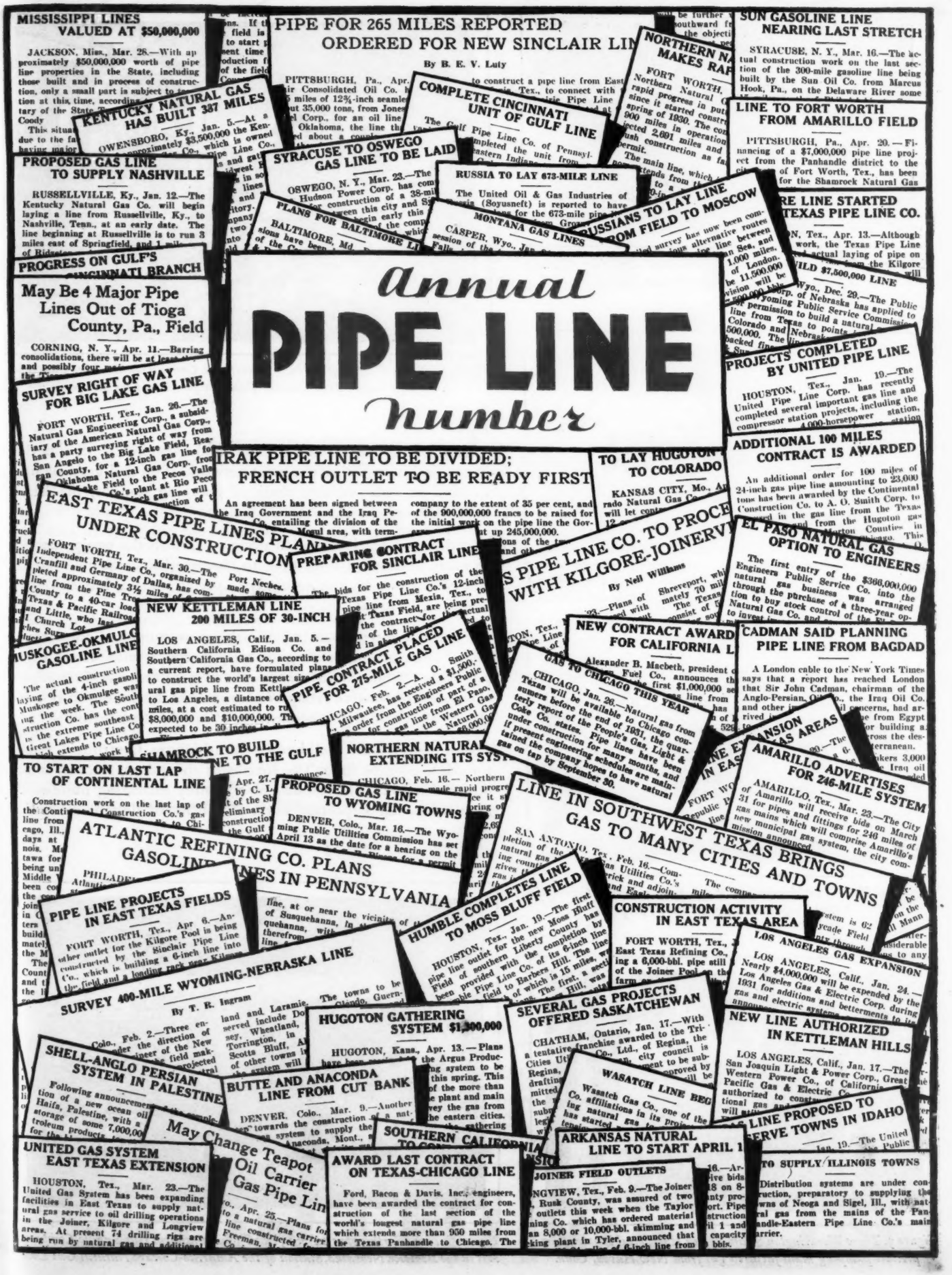
Franklin W. Kirk

Dan O'Day! Back in northwestern Pennsylvania, where the oil and gas industry was born, they speak his name with the respect that men involuntarily accord a master. For to Dan O'Day probably belongs chief credit for systematizing the method of transporting oil by pipe line.

With the success of the primitive line from the wells at West Pithole to the railroad at Pithole, similar lines multiplied rapidly in Venango, Clarion, Armstrong and Butler Counties, Pennsylvania. There was talk of a line to the seaboard, but none was built—only more small lines in the oil region. Competition became savage. Rates were cut so low that business was done at a loss and the weaker companies collapsed.

At this junction the United Pipe Lines was organized to take over numerous local lines. To Mr. O'Day, born executive and familiar with every detail of pipe line work, was assigned the task of consolidating these smaller lines, eliminating the needless ones and developing an orderly system of oil transportation. How well he did it is history. He became a towering figure in the pipe line work, a millionaire and vice president of the National Transit Co., which in the closing years of the nineteenth century was said to transport nine-tenths of the oil produced in the United States.

Others have taken Mr. O'Day's place and the business of transporting petroleum, which owes much to him, has attained proportions which even his far-seeing vision could not glimpse.


Annual
PIPE LINE
Number
MISSISSIPPI LINES VALUED AT $50,000,000
JACKSON, Miss., Mar. 28.—With approximately $50,000,000 worth of pipe line properties in the State, including those built and in process of construction, only a small part is subject to
PIPE FOR 265 MILES REPORTED ORDERED FOR NEW SINCLAIR LI
By B. E. V. Luty
PITTSBURGH, Pa., Apr.
to construct a pipe line from East
Tex., to connect with
Pipe Line
SUN GASOLINE LINE NEARING LAST STRETCH
SYRACUSE, N. Y., Mar. 16.—The actual construction work on the last section of the 300-mile gasoline line being built by the Sun Oil Co. from Marcus Hook, Pa., on the Delaware River some
KENTUCKY NATURAL GAS HAS BUILT 387 MILES
OWENSBORO, Ky., Jan. 5.—At a
approximately $3,500,000 the Ken-
which is owned
Pipe Line Co.,
COMPLETE CINCINNATI UNIT OF GULF LINE
The Gulf Pipe Line Co. of Pennsyl-
completed the unit from
Eastern Indian
NORTHERN NA
MAKES RAP
FORT WORTH,
Northern Natural G
rapid progress in put
since it started constr
spring of 1930. The con
900 miles in operation
fected 2,691 miles and
rush construction as fa
permit.
The main line, which
tends from th
to a
LINE TO FORT WORTH FROM AMARILLO FIELD
PITTSBURGH, Pa., Apr. 20.—Financing of a $7,000,000 pipe line project from the Panhandle district to the of Fort Worth, Tex., has been for the Shamrock Natural Gas
PROPOSED GAS LINE TO SUPPLY NASHVILLE
RUSSELLVILLE, Ky., Jan. 12.—The Kentucky Natural Gas Co. will begin laying a line from Russellville, Ky., to Nashville, Tenn., at an early date. The line beginning at Russellville is to run 3 miles east of Springfield, and 1 mile
SYRACUSE TO OSWEGO GAS LINE TO BE LAID
OSWEGO, N. Y., Mar. 23.—The
Hudson Power Corp. has com
for construction of a 38-mi
tween this city and Sy
begin early this
of the comp
which
RUSSIA TO LAY 673-MILE LINE
The United Oil & Gas Industries of
(Soyusneft) is reported to have
for the 673-mile pipe
MONTANA GAS LINES
CASPER, Wyo., Jan.
session of the
Falls
PLANS FOR BALTIMORE LI
BALTIMORE, Md.
have been
of the
RUSSIANS TO LAY LINE FROM FIELD TO MOSCOW
survey has now been com-
alternative routes
line between
Sea, and
1,000 miles.
London.
be 11,500,000
vision will be
500,000 bbls.
RE LINE STARTED TEXAS PIPE LINE CO.
N, Tex., Apr. 13.—Although
work, the Texas Pipe Line
actual laying of pipe on
the Kilgore
ILD $7,500,000 LINE
Wyo., Dec. 29.—The Public
Corp. of Nebraska has applied to
Wyoming Public Service Commissio
permission to build a natural
line from Texas to points
Colorado and Nebras
500,000. The
backed
PROGRESS ON GULF'S CINCINNATI BRANCH
May Be 4 Major Pipe Lines Out of Tioga County, Pa., Field
CORNING, N. Y., Apr. 11.—Barring consolidations, there will be at least
and possibly four
SURVEY RIGHT OF WAY FOR BIG LAKE GAS LINE
FORT WORTH, Tex., Jan. 26.—The Natural Gas Engineering Corp., a subsidiary of the American Natural Gas Corp., has a party surveying right of way from San Angelo to the Big Lake Field, Reagan County, for a 12-inch gas line fro
Oklahoma Natural Gas Corp. fro
Lake Field to the Pecos Valle
Co.'s plant at Rio Peco
gas line will
PROJECTS COMPLETED BY UNITED PIPE LINE
HOUSTON, Tex., Jan. 19.—The United Pipe Line Corp. has recently completed several important gas line and compressor station projects, including the
4,000-horsepower
station,
IRAK PIPE LINE TO BE DIVIDED; FRENCH OUTLET TO BE READY FIRST
An agreement has been signed between the Iraq Government and the Iraq Pe
Co. entailing the division of the
Mosul area, with term-
company to the extent of 35 per cent, and of the 900,000,000 francs to be raised for the initial work on the pipe line the Gov-
ut up 245,000,000.
TO LAY HUGOTON TO COLORADO
KANSAS CITY, Mo., A
rado Natural Gas Co.
will let cont
ADDITIONAL 100 MILES CONTRACT IS AWARDED
An additional order for 100 miles of 24-inch gas pipe line amounting to 23,000 tons has been awarded by the Continental Construction Co. to A. O. Smith Corp. to
in the gas line from the Texas
and from the Hugoton gas
Counties in
EAST TEXAS PIPE LINES PLA
UNDER CONSTRUCTION
FORT WORTH, Tex., Mar. 30.—The Independent Pipe Line Co., organized by Cranfill and Germany of Dallas, has completed approximately 3½ miles of
line from the Pine Tre
County to a 40-car load
Texas & Pacific Railroa
and Little, who las
Church Lot
PREPARING CONTRACT FOR SINCLAIR LINE
The bids for the construction of the
Texas Pipe Line Co.'s 12-inch
pipe line from Mexia, Tex., to
Texas Field, are being pre-
the contract for the actual
of the line
S PIPE LINE CO. TO PROCE
WITH KILGORE-JOINERV
By Neil Williams
Plans of
Shreveport, whi
mately 70 mil
The Texas
consist of
NEW KETTLEMAN LINE 200 MILES OF 30-INCH
LOS ANGELES, Calif., Jan. 5.—Southern California Edison Co. and Southern California Gas Co., according to a current report, have formulated plans to construct the world's largest size
ural gas pipe line from Kettle
to Los Angeles, a distance of
miles, at a cost estimated to ru
$8,000,000 and $10,000,000. Th
expected to be 30 inches in
NEW CONTRACT AWARD FOR CALIFORNIA L
Alexander R. Macbeth, president
Fuel Co., announces th
first $1,000,000 se
line from
EL PASO NATURAL GAS OPTION TO ENGINEERS
The first entry of the $366,000,000 Engineers Public Service Co. into the natural gas business was arranged through the purchase of a three-year option to buy stock control of the
Natural Gas Co. and
to invest
PIPE CONTRACT PLACED FOR 275-MILE GAS LINE
CHICAGO, Feb. 2.—A. O. Smith Milwaukee, has received a $1,500,000 order from the Engineers Public for construction of part of a gas line from El Paso, the Western Gas the Natural Gas
CADMAN SAID PLANNING PIPE LINE FROM BAGDAD
A London cable to the New York Times says that a report has reached London that Sir John Cadman, chairman of the Anglo-Persian
Co., the Iraq Oil Co. and other
oil concerns, had ar-
rived
from Egypt
for building a
cross the des-
terranean.
bakers 3,000
Iraq oil
GAS TO CHICAGO THIS YEAR
CHICAGO, Jan. 26.—Natural gas from Texas will be available to Chicago consumers before the end of 1931, the quarterly report of the People's Gas, Light & Coke Co. states. Pipe lines have been under construction for many months, and if present engineering schedules are maintained the company hopes to have natural gas on tap by September 30.
NORTHERN NATURAL EXTENDING ITS SYS
CHICAGO, Feb. 16.— Northern
made rapid progr
ce it s
ring o
construction
the Gulf
SHAMROCK TO BUILD NE TO THE GULF
Apr. 27.—
nounce-
by C. L
t of the Sh
eliminary
construction
TO START ON LAST LAP OF CONTINENTAL LINE
Construction work on the last lap of the Continental Construction Co.'s gas line from
cago, Ill.,
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being un
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the Sou
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build
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the M
The
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the li
MUSKOGEE-OKMULG GASOLINE LINE
The actual construction
laying of the 4-inch gasoli
Muskogee to Okmulgee was
ing the week. The Sout
struction Co. has the cont
in the extreme southeast
Great Lakes Pipe Line Co
which extends to Chicago.
work
PROPOSED GAS LINE TO WYOMING TOWNS
DENVER, Colo., Mar. 16.—The Wyoming Public Utilities Commission has set April 13 as the date for a hearing on the
for a permit
ATLANTIC REFINING CO. PLANS GASOLINE
NES IN PENNSYLVANIA
PHILADE
Atlanti
line, at or near the vicinity
of Susquehanna, In
quehanns, with
therefrom
line
LINE IN SOUTHWEST TEXAS BRINGS GAS TO MANY CITIES AND TOWNS
SAN ANTONIO, Tex., Feb. 16.—Com-
pletion of the
natural gas
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given t
gas
Utilities Co.'s
rick and adjoin
mile
The compa
ystem is 62
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through
siderable
to any
PIPE LINE PROJECTS IN EAST TEXAS FIELDS
FORT WORTH, Tex., Apr. 6.—Another outlet for the Kilgore Pool is being constructed by the Sinclair Pipe Line Co., which is building a 6-inch line into the field and a loading rack near Kilgore
HUMBLE COMPLETES LINE TO MOSS BLUFF FIELD
HOUSTON, Tex., Jan. 10.—The first pipe line outlet for the new Moss Bluff Field of southern Liberty County has been provided with the completion by the Humble Pipe Line Co. of its 6-inch line from Moss Bluff to Barbers Hill. The line
field to Barbers Hill, 15 miles, w
of which is
The first, a sect
Hill, was
CONSTRUCTION ACTIVITY IN EAST TEXAS AREA
FORT WORTH, Tex.,
East Texas Refining Co.,
ing a 6,000-bbl. pipe still
of the Joiner Pool on th
farm
AMARILLO ADVERTISES FOR 246-MILE SYSTEM
AMARILLO, Tex., Mar. 23.—The City of Amarillo will receive bids on March 31 for pipes and fittings for 246 miles of gas mains which will comprise Amarillo's new municipal gas system, the city commission announced.
SURVEY 400-MILE WYOMING-NEBRASKA LINE
By T. R. Ingram
land and Laramie.
served include Do
sey, Wheatland,
Torrington, in
Scotts Bluff,
of other towns i
the system will
The towns to be
Glendo, Guern-
HUGOTON GATHERING SYSTEM $1,300,000
HUGOTON, Kans., Apr. 13.—Plans
have been
the Argus Produc-
ing system to be
this spring. This
of the more than
e plant and main
ey the gas from
he eastern cities.
the gathering
SEVERAL GAS PROJECTS OFFERED SASKATCHEWAN
CHATHAM, Ontario, Jan. 17.—With a tentative franchise awarded to the Tri-Cities Uti
Ltd., of Regina, the
Regina, city council is
drafting
ment to be sub-
mitted
proved by
the
will be
subj
legis
WASATCH LINE BEG
Wasatch Gas Co., one of the
Co. affiliations in its prog
ing natural gas to
has started
fensive
LOS ANGELES GAS EXPANSION
LOS ANGELES, Calif., Jan. 24.—Nearly $4,000,000 will be expended by the Los Angeles Gas & Electric Corp. during 1931 for additions and betterments to its gas and electric systems
NEW LINE AUTHORIZED IN KETTLEMAN HILLS
LOS ANGELES, Calif., Jan. 17.—The San Joaquin Light & Power Corp., Great Western Power Co., of California
Pacific Gas & Electric Co.
authorized to construct
tional gas
will
SHELL-ANGLO PERSIAN SYSTEM IN PALESTINE
Following announcement
tion of a new ocean oil
Haifa, Palestine, with a
storage of some 7,000,00
troleum products
for the
BUTTE AND ANACONDA LINE FROM CUT BANK
DENVER, Colo., Mar. 9.—Another
line" towards the construction of a nat
system to supply the
Anaconda, Mont.,
May Change Teapot Oil Carrier Gas Pipe Lin
o., Apr. 25.—Plans for
to a natural gas carrier
line constructed
Freeman,
Co.
SOUTHERN CALIFORNIA TO CON
AWARD LAST CONTRACT ON TEXAS-CHICAGO LINE
Ford, Bacon & Davis, Inc., engineers, have been awarded the contract for construction of the last section of the world's longest natural gas pipe line which extends more than 950 miles from the Texas Panhandle to Chicago. The
ARKANSAS NATURAL LINE TO START APRIL 1
JOINER FIELD OUTLETS
NGVIEW, Tex., Feb. 9.—The Joiner
, Rusk County, was assured of two
outlets this week when the Taylor
ning Co. which has ordered material
an 8,000 or 10,000-bbl. skimming and
king plant in Tyler, announced that
-inch line from
16.—Ar-
ive bids
18 on 8-
nty pro-
ort. Pipe
nstruction
il 1 and
capacity
bbls.
LINE PROPOSED TO SERVE TOWNS IN IDAHO
Jan. 19.—The United
Public
TO SUPPLY ILLINOIS TOWNS
Distribution systems are under construction, preparatory to supplying the towns of Neoga and Sigel, Ill., with natural gas from the mains of the Panhandle-Eastern Pipe Line Co.'s main carrier.
UNITED GAS SYSTEM EAST TEXAS EXTENSION
HOUSTON, Tex., Mar. 23.—The United Gas System has been expanding facilities in East Texas to supply natural gas service to oil drilling operations in the Joiner, Kilgore and Longview areas. At present 74 drilling rigs are being run by natural gas and additional

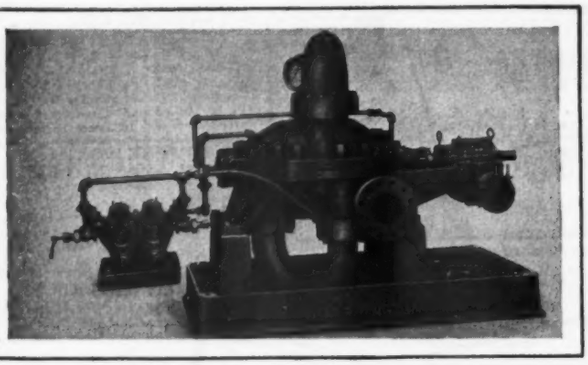

Figure 2. Worthington No. 4 Three-stage Centrifugal Pump for Gasoline Line Service

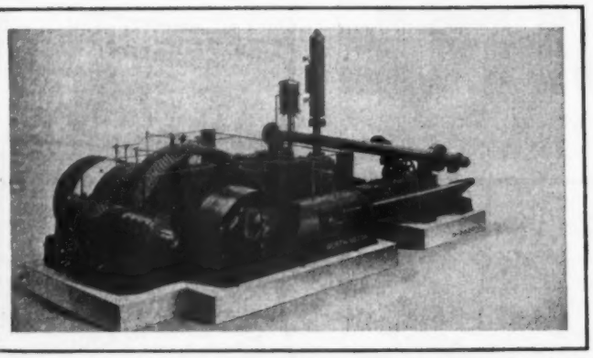

Figure 3. Worthington 6" x 18" Horizontal Triplex Power Pump as furnished for Gulf's Oklahoma-Pennsylvania Oil Line

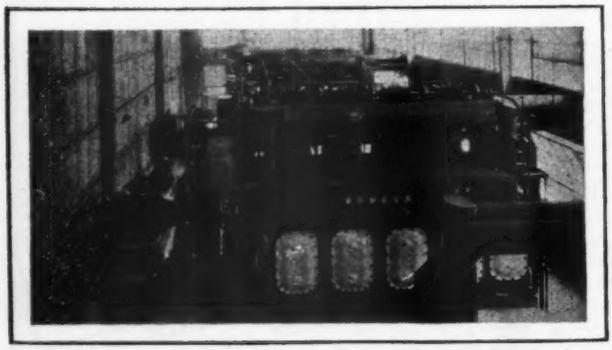

Figure 4. Two Worthington 17" x 25" Four-cylinder, Four-cycle Diesel Engines driving Oil Line Pumps

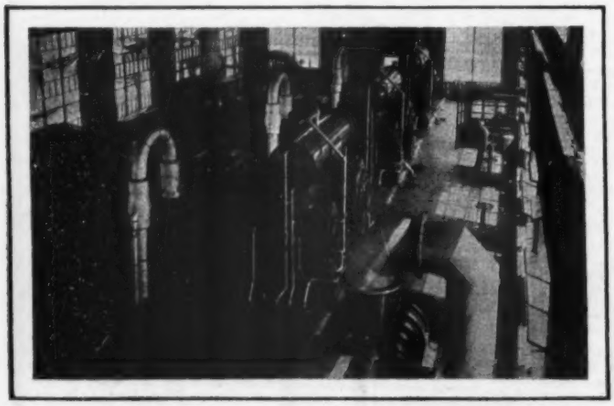

Figure 5. Three Worthington Steam-driven Horizontal Duplex Compressors pumping manufactured gas from New Haven, Conn.

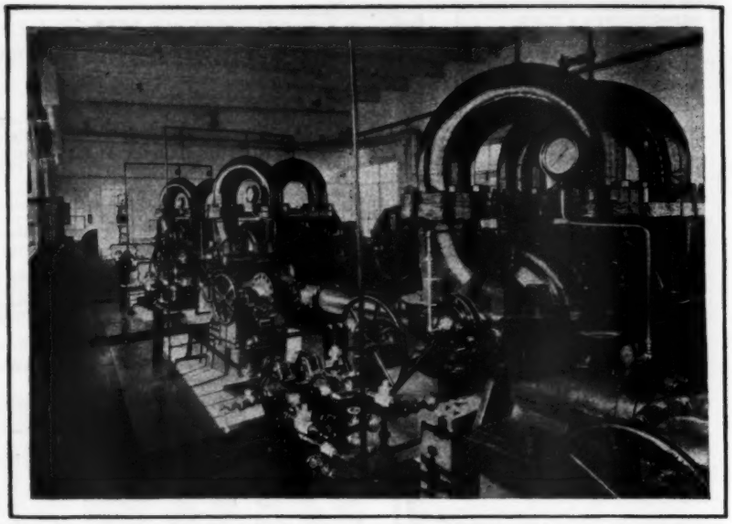

Figure 1. Three Worthington No. 8 Four-Stage Centrifugal Oil Line Pumps in the Cole Camp, Mo., Station, Texas-Empire Pipe Line Company

THE modern demand for rapid and economical distribution has brought into being the great network of oil and gas pipe lines . . . and its indispensable chain of pumping stations, the heart back of the arteries.

Worthington has been called upon to furnish the equipment for so many of those stations that, to characterize adequately the extent of this service, it is necessary to use an unusual but expressive word . . . Ubiquity.

To list the installations of Worthington Pumps, Compressors, Diesel Engines and Gas Engines on pipe line service would be to publish a "Who's Who" of the oil and gas industries. Instead, we show a representative group of photographs illustrating six distinct classes of Worthington products used in operating the lines.

Figure 1 shows the well-known Worthington Centrifugal Pump for crude oil pipe lines. The success of this pump, since its introduction in 1927, has resulted in a steadily increasing number of installations on important lines. Simplicity of design, reliability

Figure 6. Five Worthington 24" x 13" x 36" Twin-tandem Gas Engine Compressors in the Beatrice, Nebraska, Station of the Amarillo-Chicago Natural Gas Line

UBIQUITY

in Pipe Line Service

and high efficiency are the outstanding characteristics responsible for its acceptance. It is built in capacities of 10,000 to 90,000 bbl. per day.

Figure 2 is the Worthington Centrifugal Pump for gasoline pipe lines. It embodies the loop inter-stage passage, internal bearing, single stuffing box and other proven points of the crude oil pump, plus features developed specifically to meet the requirements of gasoline pumping.

Figure 3 is the Worthington Motor-driven Horizontal Power Pump for crude oil pipe lines, furnished in either duplex or triplex type. Its forged steel cylinders are a positive protection against breakage in high pressure oil service. Large bearings, valves accessible from above, and elimination of gaskets on valve hole plugs are among the features that contribute to its good performance.

Figure 4 shows the Worthington Vertical Four-cycle Air-injection Diesel Engine used to drive power pumps in oil pipe line duty. For this class of service, Worthington offers a complete line of Diesels in ranges of power, through various types, from 50 hp. to 12,000 hp.

Figure 5 represents the Worthington Horizontal Duplex Compressor, in wide use for the pumping of manufactured gas. This type of compressor is furnished with either steam or electric motor drive, and brings to the gas industry notable developments in design, including the Feather Valve and the electrically-operated five-step variable-capacity control.

Figure 6 illustrates the Worthington Gas-engine-driven Gas Compressor, used in more than 50% of the natural gas pipe line stations, as exemplified by the first unit of this type, built in 1900 for the Columbia Natural Gas Company, and the 57 units now being installed on the Amarillo-Chicago Line.

Thus, to pipe line operators, Worthington offers an experience and a range of products that are factors to be considered whenever installations are planned. At the nearest Worthington office you will find engineers qualified to discuss the application of Worthington equipment to *any* pipe line requirement.

PUMPS *All Sizes...All Types* *For All Services* *Any Capacity...Any Pressure*	COMPRESSORS *Stationary and Portable*
CONDENSERS and Auxiliaries	ROCK DRILLS
DIESEL ENGINES	AUTOMATIC HEAT TREATING MACHINES FOR DRILL STEEL
GAS ENGINES	FORGING FURNACES FOR DRILL STEEL
FEEDWATER HEATERS	DRILL STEEL
WATER, OIL and GASOLINE METERS	ACCESSORIES
MULTI-V-DRIVES	CHROMIUM PLATING

Literature on request

WORTHINGTON PUMP AND MACHINERY CORPORATION

Works: Harrison, N. J. Cincinnati, Ohio Buffalo, N.Y. Holyoke, Mass.

Executive Offices: 2 Park Avenue, New York, N.Y.

GENERAL OFFICES: HARRISON, N. J.

District Sales Offices and Representatives:

ATLANTA	CHICAGO	DALLAS	EL PASO	LOS ANGELES	PHILADELPHIA	ST. PAUL	SEATTLE
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BUFFALO	CLEVELAND	DETROIT	KANSAS CITY	NEW YORK	ST. LOUIS	SAN FRANCISCO	WASHINGTON

Branch Offices or Representatives in Principal Cities of all Foreign Countries

6-80

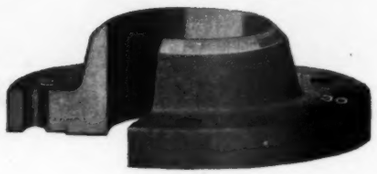
WORTHINGTON

Materials scientifically designed for oil and gas pipe lines. . . . Meeting all requirements from well to consumer

FOR where high pressures are to be applied in pumping oil and gas through thousands of miles of pipe, for where rivers are to be crossed, for where motor operated control of valves from a central point is desirable, for every one of the special and regular needs which arise in building the great pipe lines that transport oil and gas today, Crane valves and fittings and other piping equipment are supplied.

The materials here illustrated are now in use in the most important pipe lines in the country. The regular Crane line of valves and fittings will meet all ordinary situations. If conditions are encountered where these are not wholly suitable, Crane Co. is completely equipped, experienced, and ready to make up materials to your specifications and exactly to your needs.

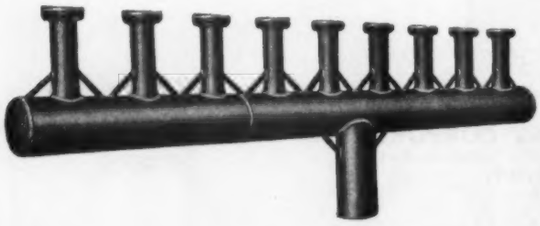
Write us for full information about materials for your line. Let us send one of our specialists in oil and gas piping to advise you in choosing materials. Their experience with virtually every situation that has arisen in the past in oil and gas piping installations and the 76 year Crane experience in manufacturing will save you money and assure a dependable result.



● *Crane Forged Steel Flange with welding neck No. 296-E. Series 30. For 500 pounds oil, gas or water working pressures at atmospheric temperatures.*

● *Crane Double Disc Gate Valve No. 349-E, with "built-around" by-pass and auxiliary valves. Made up for gas pipe lines. Ferrosteel body, bonnet, and discs. Crane Special Brass mountings. 500 pounds gas working pressures. Similar to those used in pipe lines of the following companies: Mississippi River Fuel Corporation, Southern Natural Gas Company, Interstate Natural Gas Company, United Gas Corporation, Southern Fuel Company, Panhandle Eastern Pipeline Co., Missouri-Kansas Pipe Line Co., Empire Company, West Texas Gas Company.*

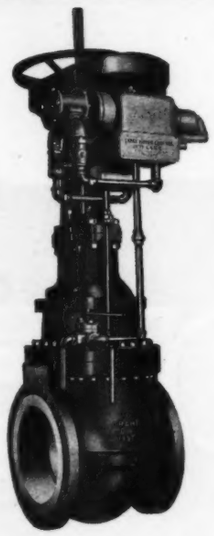
● *Crane No. 46½-A. Emergency Stop Valve. Extra heavy. With electrical release and open by-pass to equalize pressure. Made in Cast Steel. Exelloy trimmed, similar to the valves furnished to control river crossings Phillips Natural Gasoline Pipe Line.*



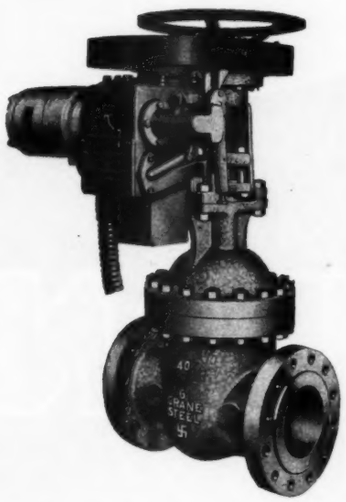
● *River crossing header made up for and used by the Southern Natural Gas Corporation. Of wrought steel. Valves and other piping materials particularly designed for use at river crossings have been specially planned and manufactured by Crane Co. and are in use in the largest new oil and gas pipe lines in the country.*

● *Crane Forged Steel Welding Tee No. 353-E. In combination with welding elbow No. 352-E, gives opportunity to make up virtually any combination of welded joints in a standard weight piping installation. For 800 pounds non-shock gas, oil, or water working pressure at atmospheric temperatures.*

● *Station Header. Typical fabricated headers used in piping or pumping stations for gas and oil pipe lines. This material fabricated in the shop and tested before shipping to the field.*



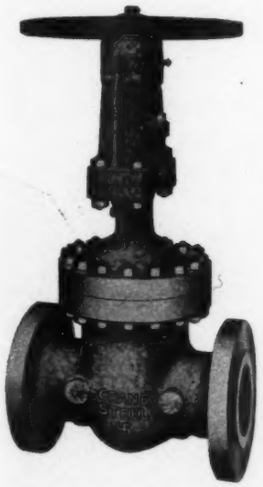
● *20-inch air motor operated gate valve for 500 pounds gas working pressure. Many years of research and work by Crane engineers and technicians went into the designing of Crane motor control for valves. The result is a dependable apparatus, sensitive as human hands. Motor operated valves for every situation where such equipment is desirable can be supplied. Similar to those used in Missouri-Valley Pipe Line.*



● *Crane Cast Steel Motor Operated Gate Valve. For cast and forged steel valves controlling high pressures and temperatures, as well as for large iron and ferro-steel valves; to control oil or gas wells, oil or gas pipe lines, high temperature, high pressure valves in refineries, and any place where remote control is desired, the dependable efficient Crane motor operating mechanism is supplied. The Series 40 valve is for 800 pounds non-shock working pressure at atmospheric temperatures: 400 pounds at 750° F.; 375 pounds at 900° F.*

● *Crane Cast Steel Solid Wedge Gate Valve with dust cover and double gears. Exelloy disc, body seat rings, and stem. Series 30, 500 pounds non-shock oil, gas, and water working pressures at atmospheric temperatures. Similar to valves furnished on the Southern Fuel Co. and Western Natural Gas Co. lines.*

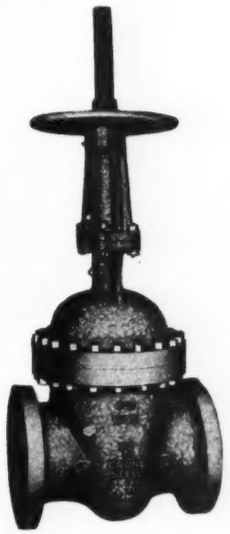
● *Crane Cast Steel Double Disc Gate Valve. Eighteen inch. Double gears. Dust cover protects exposed working parts. Disc, body seat ring, and stem are of Exelloy. Series 40, for 800 pounds oil, gas, or water non-shock working pressures at atmospheric temperatures. This line of valves was used by the Continental Construction Corporation.*



● *Crane Cast Steel Wedge Gate Valve. Eight inch. Ball bearing. Series 40. Disc, body seat rings, disc rings, and stem are of Exelloy. For oil, gas, and water non-shock working pressures of 800 pounds at atmospheric temperatures. This type of valve used in Phillips Natural Gasoline Pipe Line.*

● *Crane No. 352-E. Forged steel welding elbow. Easily and quickly installed. Eliminates much cutting and fitting in making a branch connection and gives neater, better joint. For 800 pounds non-shock gas, oil, or water working pressures at atmospheric temperatures.*

● *Cranelap Welding Necks are made using full thickness square corner Cranelap joint with loose flange to make alignment easy for welding nipple into a line at the scarfed end.*

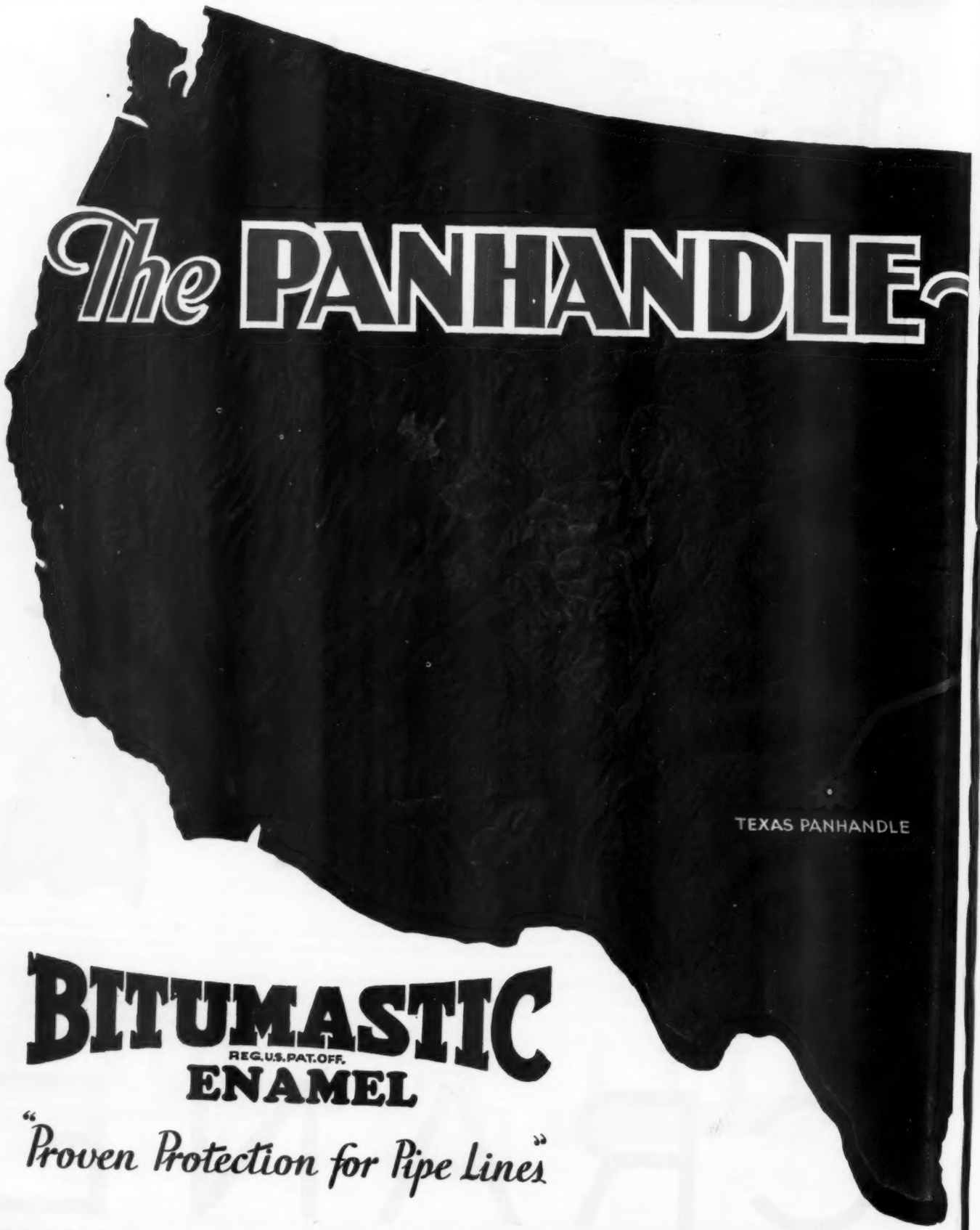


● *Crane Cast Steel Double Disc Gate Valve. Twelve inch. Dust cover protects exposed working parts. Disc, body seat ring, and stem are of Exelloy. Series 40 for 800 pounds oil, gas, or water non-shock working pressures at atmospheric temperatures. Used by the Continental Construction Corporation.*

CRANE

PIPING MATERIALS TO CONVEY AND CONTROL STEAM, LIQUIDS, OILS, GAS, CHEMICALS

CRANE CO., GENERAL OFFICES: 836 S. MICHIGAN AVENUE, CHICAGO
NEW YORK OFFICES: 23 WEST 44TH STREET
Branches and Sales Offices in Two Hundred Cities



BITUMASTIC
REG. U.S. PAT. OFF.
ENAMEL

"Proven Protection for Pipe Lines"

Despite problems which would have made such a gigantic undertaking seem quite impossible a few years ago, the 1000-mile Panhandle-Eastern line soon will be serving an inland empire extending from the plains of the Texas Panhandle to the Illinois-Indiana state line.

Engineers of the type who conceive and construct pipe line projects of such magnitude know that buried steel pipe will eventually be destroyed by corrosion—*unless it is adequately protected.* Insurance against depreciation is imperative.

For this reason every foot of this line is coated. Approximately 85% of the completed line has been or will be protected with *Bitumastic Enamel.*

Bitumastic Enamel has not been used to protect *all* of the big lines laid in recent years. But it has been used on *most* of them, either wholly or in part—and where in part, invariably on those sections where corrosive conditions were adjudged most severe. *There is no substitute for experience.*

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Wailes Dove-Hermiston Corporation

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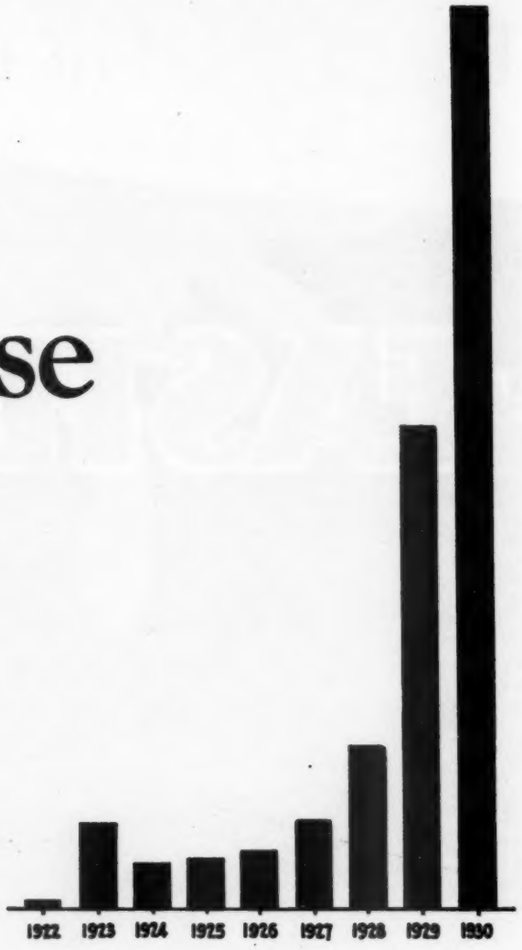
CHICAGO CLEVELAND SAN FRANCISCO PHILADELPHIA LOS ANGELES HOUSTON

88% Increase

in Gas Main and Pipe Line Construction



In 1930 our gas main and pipe line construction was 88% greater than in the previous year. And in 1929 this work showed an increase over 1928 of 150%.

The experience of our organization, trained in gas main and pipe line construction, is available for work of any character, in congested districts, cross-country, river crossings, etc.

THE U. G. I. CONTRACTING COMPANY
DIVISION OF
UNITED ENGINEERS & CONSTRUCTORS
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112 North Broad Street

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MAXIMUM RETURN TO CLIENTS PER DOLLAR INVESTED

The Trend of Oil Pipe Line Practice

Both Economic and Physical Changes Experienced During Past Year as Result of Developments. Many Improvements Noted

By William G. Heltzel

During the past year the pipe line industry has experienced both economic and physical changes in its established practices. The former change has resulted from the economic developments in the oil-producing branch of the industry, and the physical changes in the operating practices have resulted from the industry's continued policy of adopting new and better methods. The pipe line industry is experiencing only the beginning of the trend in economic changes, while on the other hand the physical changes which have been going on in the pipe line industry for the last three or four years have resulted in some new established practices. During this period the pipe line engineer has been experimenting with new types of equipment, construction methods, pipe, pipe joints, pumping stations, etc., and during this short time more radical changes have come about than in the whole of the previous history of the pipe line industry.

From the economic viewpoint some of the significant developments during the past year have been:

1. Discovery of prolific oil fields by scientific methods which has resulted in:
   (a) The gathering of a large percentage of oil from flush fields.
   (b) Distressed stripper production.
   (c) Proration.
2. Building of two large oil trunk lines for the delivery of oil to refineries in Ohio and Pennsylvania. One of these pipe lines was built under a joint ownership.
3. Building of large natural gas lines to Kansas City, Chicago, St. Louis and other eastern points.

Economic Effect on Pipe Lines

The discovery of such prolific oil fields as Greater Seminole, Oklahoma City and the East Texas group has made available to the industry a large supply of petroleum in small areas. This development has made it possible for the pipe line companies to gather a high percentage of their oil in these pools through a pipe line gathering system confined to these areas rather than by gathering small quantities of oil through systems extending over a whole state. Thus the extensions to gathering systems have been confined largely to the large producing oil fields.

In the days of shallow drilling and small initial producing wells, oil fields scattered over two or three states were being developed at the same time. The industry needed oil and competitive pipe lines were built hurriedly into these fields to get it. The development of the small shallow oil pools during the last 30 years resulted in the building up of small, but extensive, gathering systems which the older and larger pipe line companies have on their hands today.

Petroleum can be gathered in the prolific oil field much more economically than it can be from many oil wells scattered over a large area. And it is a fact that the gathering of oil in the old producing oil fields is done in many cases at a loss to the pipe line company. In times when oil is needed this loss is sustained by the pipe line company as a matter of necessity; but in these times of prolific oil production some of the pipe line companies, not encumbered with gathering systems in the old producing fields, have taken advantage of the opportunity to gather oil at the lowest cost, which gives these pipe line companies competitive advantages. As a result of this condition the small producing wells have become less desirable connections. The economic pressure on the old gathering systems has brought about one of the industry's recent problems, namely—"distressed oil and stripper production."

Today the lane of travel for pipe line construction equipment is along the pipe line right of way.

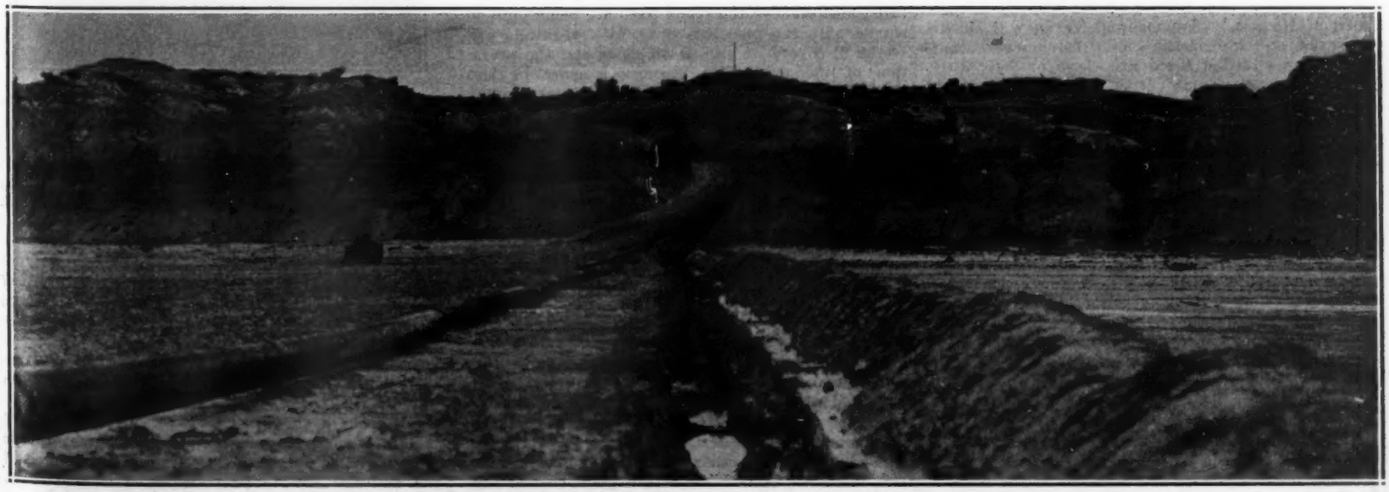
Probably never before in the history of the oil industry has there existed such a condition as has been experienced part of this year when settled oil production was without pipe line connections. Although most of this distressed production has pipe line connections at the present time, the importance of the economic situation must not be overlooked. The gathering systems in the old settled producing fields is under economic pressure and will continue to remain under this stress as long as large "flush" oil pools are discovered in their midst.

In view of the fact that the oil-producing branch of the industry has fairly accurate means of discovering oil fields and that it has equipment to drill to 7,000-foot depths in a period of 60 to 90 days, it is logical to conclude that the producing branch of the industry will follow out the purpose of searching for prolific oil fields. At the present time the outlook for such a condition is promising, and it is believed that pipe line companies should anticipate such economic and operating conditions as they have experienced in the development of the Greater Seminole and Oklahoma City Pools, and also conclude that their old and scattered gathering systems will remain under the economic pressure which has been experienced this year.

Old Practices Are Cited

The solution of this problem will depend largely on the co-operative efforts of the pipe line companies and the producers in practicing a strict economy in the gathering of the oil from the areas of declining production. As an example, about 300 miles of 2, 3, 4 and 6-inch pipe are required in one old field gathering system to collect between 1,500 and 1,800 bbls. of oil per day. In the "flush" pools, a like amount of oil can be run from one tank at one gauging. To maintain and operate without a loss 300 miles of pipe line to gather 1,500 or 1,800 bbls. of oil will require unusual economy.

The producers in some of the old settled fields have been accustomed to unusual service in the running of their oil; this service was developed by the pipe line companies in the days when oil was less plentiful and a lease connection was eagerly sought. Economical and profitable operations were



Oil and gas trunk lines follow their direct course across country notwithstanding physical barriers.

sacrificed by the pipe line companies for lease connections. Perhaps an enumeration of some of the inconveniences causing the pipe line companies higher operating costs in the old settled fields will aid the producers in any plan to co-operate with the pipe line companies. In some of the older fields, stock tanks as small as 25 bbls. and many of them 45 bbls. have been used by the producers to store the oil for pipe line runs. At the end of each month many of the lease owners desire all of the oil in their tanks run even though the tank contained only 15 bbls. And at the present time one will find many small tracts of land producing oil in the old settled fields and the production on them is small. Also in the past, producers in the old settled fields

Neither rivers nor mountains thwart the course of oil and gas pipe lines.

have made changes in tank or pump settings on their leases which have put the pipe line companies to considerable expense in changing their lines. A further inconvenience to the pipe line companies in the old fields has been that the pipe line gaugers have made frequent trips to leases and have not been able to run the oil because the oil producers' lease pumper could not be found to witness the gauge or sign the ticket, and often in case of bad oil the pipe line gauger has been called frequently to run oil which had to be turned down either because "bottoms" were high or the oil was not merchantable. The greatest maintenance costs for pipe lines and the greatest loss of oil in the "stripper" producing areas result from the corrosion of the pipe lines on the leases and often adjacent to lease tanks where the salt water from the lease tanks is allowed to flow uncontrolled over the pipe lines. All of these complaints, when aggregated, account for much of the pipe line operating expense in the old gathering systems, and the producers' co-operation must be obtained to make possible the gathering of oil from the "stripper" wells without a large loss to the pipe line company.

A map of the pipe line gathering systems in the states of Kansas, Oklahoma and Texas will show that even in some of the oldest fields where the production is settled there are three or four different pipe line systems gathering a small amount of oil in a field. In particular, there is a small oil field in Oklahoma producing about 400 bbls. per day and there are four pipe line companies gathering these 400 bbls. of oil. Such violations of economical and profitable operation are numerous and they have been brought about by the competition for oil when it was scarce. With the old gathering systems under the existing stress, which is liable to continue, it behooves the pipe line companies to work out an economical arrangement whereby one company is left to serve the whole field. This is one of the possible remedies to relieve the economic pressure on gathering systems in the fields of declining production. Little can be accomplished in making operations economical for any one company until such a move is made.

If a single pipe line company is left in a field of small production to gather the oil, it is then possible for the one company to remove some of the operating handicaps that burdened all of the other companies previously. For example, one company could afford to install automatic or semiautomatic pumping stations whereas in many cases there was not enough oil to warrant any improvement as long as three or four pipe line companies gathered the oil.

Proration

The developing of the prolific oil fields has made available a greater supply of petroleum than needed for the current demand for petroleum products. As a result, the production of these flush oil fields has been shut in and prorated to meet the demand. The general practice of "shutting in" oil wells is a development that has come only with the oversupply of petroleum. From the viewpoint of the pipe line company it is an operating advantage in not being required to provide facilities to take care of high peak production out of an oil-producing field for a short time, which was the general practice two years ago. If a well produced 20,000 bbls. of oil the well was allowed to flow continuously and the pipe line companies had to have facilities to handle this amount of oil, and likewise for the whole field the pipe line facilities had to be developed along with the production until the peak was reached and then a rather sudden drop in production from the field usually resulted. The pipe line companies found by experience that this practice brought about overdeveloped facilities. The practice of shutting in oil fields has made it possible for the pipe line

Bridges across ravines, creeks, and small rivers are coming into use for oil and gas lines.

companies to build their gathering systems and conduct their operations in a more orderly manner.

However, drastic proration in some of the fields has made it necessary for the pipe line companies to extend their gathering systems within the area of a field and make more lease connections than was necessary previously to gather the same amount of the oil. The lateral feeder lines from the prorated flush field to the trunk lines are being built to supply only the pipe line companies' requirements. If the discovery of prolific oil fields and the proration of the production becomes a more or less permanent condition, the pipe line companies may become burdened with a greater investment in a gathering system within a field than has been customary. If such a condition develops, which would increase the operating cost, or if any economic condition should bring about lower revenues for gathering the oil, there may be a trend either to zoning the field for pipe line connections or the building of gathering systems under a joint ownership with an arrangement for the interchange of oil between the pipe line stations after the oil has been gathered.

Oil Lines East

While gasoline lines were being built from Oklahoma east to St. Louis and from the Atlantic Seaboard west, two large trunk lines were being built from the Mid-Continent area to deliver oil east of the Mississippi River. One line was built all the way from the State of Oklahoma to the State of Pennsylvania. The other trunk oil line was built from the State of Oklahoma to a point east of the Mississippi River where it made connections with an older pipe line system for crude oil deliveries in the State of Ohio. The construction of these oil trunk lines is a good indication of a continued trend in the movement of crude oil from the Mid-Continent oil fields to the refineries in Ohio and western Pennsylvania.

It is noteworthy that during the last two or three years some important trunk lines have been built under a joint ownership. Such an arrangement makes it possible to operate a trunk line system more nearly at capacity and at lower costs than transporting the oil in smaller volumes through individual company lines. The joint ownership of such a trunk pipe line system minimizes the financial risk for each company. And such an arrangement also helps to avoid the uneconomic overdevelopment of oil pipe line facilities.

Natural Gas Pipe Lines

The extensive construction of crude oil, gasoline and natural gas pipe lines are indices of a fast trend to the use of liquid and gaseous fuels in the United States. Our present pipe line systems are only the beginning of a vast system for the distribution of liquid and gaseous fuels. The public has hesitated to use fuel oil, because it has been fearful of the supply; but if our supply of petroleum continues unabated or the reserves become known, fuel oil may come into extensive use. The natural gas pipe line transports a fuel which is competitive with fuel oil, a derivative of the crude oil transported by pipe lines. At the present time the economic relationship between the crude oil pipe line and the natural gas pipe line may be remote; but it is worth remembering that the two different pipe lines are transporting competitive fuels.

Changes in Physical Practices

The past year has marked the end of many old pipe line methods and practices. After three years

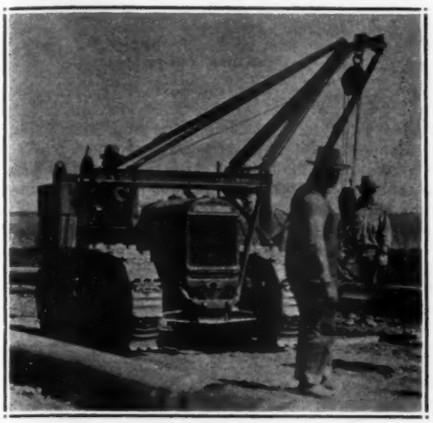
The ditching machine digs the trench across country for oil and gas pipe lines.

of experimenting with different kinds of pipe, welding, couplings, pumps, construction equipment, etc., some definite new practices are becoming established.

Construction Methods

In the days of the screwed pipe line, and that was only two or three years ago, the construction of pipe lines was done largely by man power and hand tools. This type of construction of trunk pipe lines is obsolete today; the machine, in its variety of forms, has taken its place. When the pipe lines were built largely by man power and hand tools a narrow right of way across the country was sufficient, and, in the more difficult places, pipe and materials were moved into place by horse or man power. When gulleys or ravines were to be crossed the material had to be transported around them. And wherever nature's barriers were in the way, man and beast yielded to the easiest road; but

today the pipe line equipment follows along the course of the pipe line. The right of way crews go ahead and clear the way of all obstacles; timber is cleared; the rocky slopes of hills are blasted; grades on ravines and gulleys are dug; creeks and ravines are bridged—all is made ready for the continuous movement of the pipe line crews straight ahead. The heavy equipment used on pipe lines today cannot take devious routes off the course of the pipe line; it is too heavy for the bridges on



Only heavy tractors can handle the large diameter pipe used in pipe lines of today.

country roads and it is too slow to travel long distances in going around barriers—so the barriers must be moved and the equipment moves directly forward.

Powerful right of way machines, ditchers, tractors, compressors, trucks, electric welding machines and backfilling machines move forward in a slow but steady procession over hundreds of miles of pipe line right of way, completing a good job as they go. Compressors are used for blasting work and right of way machines clear away the boulders, cut down the grades and excavate the approaches to the creek and river crossings. Heavy trucks transport and string the pipe and material along the right of way. Then come the tractors and the "firing line" crews which line up the pipe and weld into sections. And still another group of tractors come along and put the sections in position over the ditch to be tied-in as a part of the pipe line. The heavy tractors lift, convey, bend and lower the pipe into the ditch. The ditch is backfilled with a special machine, and the line is tested perhaps with a portable air compressor. The building of a pipe line used to be a procession of men and teams across the country; today it is a procession of many machines and a few men.

Welding Is An Established Practice

Oil trunk pipe lines are laid today only with welded joints, either electrically or gas welded. Welding is an established practice in the pipe line industry for joining the lengths of pipe, and the screwed joint has become obsolete. This type of construction has proved its worth over a number of years of service. Welding has revolutionized piping systems and connections at pump stations, in manifolds, tank connections, gate junctions, etc. The manufacturers have introduced forged steel fittings designed especially for welding. Such fittings include forged short radius bends, tees and forged hub flanges. The welded construction has not only proved reliable against failure in the joints, but it has also eliminated the leakage that always occurred in screwed joints. Welding has been one of the outstanding developments in the pipe line industry.

Until the last two years most of the welding in pipe line work was done by the oxy-acetylene method, but during the last year electrical welding has come into extensive use.

For some time, engineers were undecided on the type of joint to provide for electrical welding; but after many tests the double-bell end joint with a back-up ring inserted in the bell recess has proved the most reliable for electrical welding and this type of joint has come into common use. This development, along with the fact that the electrical weld can be made ductile and at a high speed, accounts for the extensive use of it for pipe line construction. In the patching of operating oil lines the electrical weld is used almost exclusively. For the fabrication of piping systems, involving fittings, flanges, etc., the electrical weld is used extensively to avoid warping.

For pipe line construction, using pipe with a straight butt joint beveled for welding, the oxy-acetylene method is used. The electrical weld has not been used satisfactorily on this type of joint. To meet the speed of the electrical weld, a high-speed oxy-acetlyene welding rod and method has been developed and is being used.

One of the principal problems in the operation of a pipe line system is combatting the corrosion of the underground lines. Sometimes this corrosion will cause only a small hole in the pipe and at other times many feet of the pipe must be repaired. Until a year or two ago it was customary to put a heavy cast iron saddle clamp and gasket over the small hole in the pipe, and in case much of the pipe was badly corroded the pipe line was cut, the oil drained out of it into a pit or pond and new pipe put back in. Before the days of welding, screwed joints were set in and connected into the line with a cast iron flange union, and forever thereafter the saddle clamp or the flange union would cause trouble. On such a job as this considerable expense

The "line up" and "firing line" crews weld the pipe into sections.

resulted either from the cost of digging a hole for receiving the oil or from the damage to the land caused by the oil drainage.

Since the advent of electrical welding for pipe line work, the procedure for repair work on corroded lines has been simplified. In case of an oil leak due to a corrosion hole in the pipe, one to three men are sent out to the leak and they put on a gasket and a light-weight steel clamp, which can be handled easily by one man. The clamp is drawn tight by U-bolts and when convenient, an electrical welding truck will go to the point where the leak has occurred, and the patch put on previously will be welded to the line and the U-bolts will be removed. This is known as patching, and it is done only by electrical welding. Some companies do not shut out of the line during the electrical welding of the patch to the line; but it is believed to be good practice to remove the operating pressure from the line.

If a large number of corrosion pits are found on the pipe, it has become a practice to "half sole" the line. Often the bottom half of the pipe line is found to be badly pitted and in such cases a piece of plate of a necessary length and width is cut from a pipe of the corresponding diameter and formed to fit over the outside diameter of the pipe to be repaired. This large patch is put over the corroded area and welded to the pipe in the same manner as described above for the smaller patch. After the job has been completed compressed air is forced in between the pipe and the patch plate and the welds are tested with soap suds for leaks.

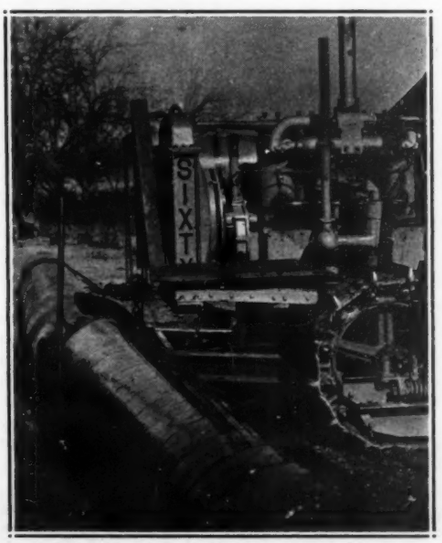
There are many cases, however, where the whole pipe is badly corroded. If the oil drainage to such a point is large, it is usual practice to split a larger diameter pipe and incase the corroded line. The casing is electrically welded along the split seams and it is swaged down at the ends to fit the pipe and electrically welded to the pipe line. Likewise the welding on the casing is tested with compressed air and soap suds. This method of repair saves much shutdown time for draining the line, removing the pipe and completing the job. And often a shutdown cannot be obtained for such a repair job.

The screwed couplings in the pipe lines laid before the use of welding are subject to considerable leakage. Usually the line walker has caulked these couplings to stop the leaks; but the caulking does not hold long, and leakage starts again. One of the repair jobs on these screwed lines is electrically welding both sides of leaking coupling, if the coupling will take the heat of the arc without springing a larger leak. If the coupling cannot be electrically welded on both sides on account of the nature of the leak, it is customary to fit a swaged sleeve over the coupling, inclosing it and welding the sleeve along the split seams and at the swaged ends to the pipe. Often the sleeve has to be used, because the pipe adjacent to the face of the leaking coupling is usually corroded by the oil leak and the sleeve must extend over this corroded area.

Frequently some of the old cast iron flange unions which were put in the line in the past to "flange up" a repair job leak badly; and if the oil drainage from the line at that point is too great to permit cutting out the flange, the flange is inclosed in a swaged sleeve such as is used for leaking couplings. An accompanying photograph shows such a repair job in which a 10-inch swaged sleeve was fitted over an 8-inch flange union. In all of this repair work described above the welding has been done electrically.

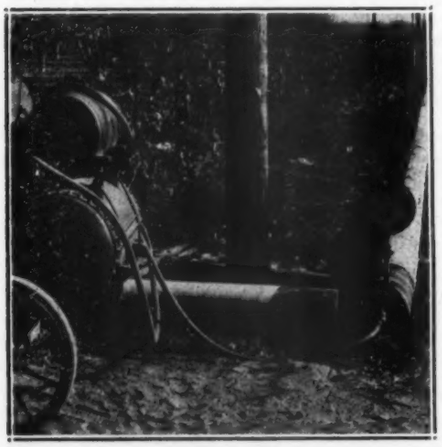
Compressed Air Used for Draining Lines

Whenever it is necessary to cut an oil line in a trunk line system for putting in replacements, lowering or moving the line, the oil drainage is often large and usually there is no place to store the oil without causing considerable damage or loss of oil. If there is a system of multiple lines where such work is to be done, it is customary to transfer the



Machinery is used for bending the pipe.

drainage oil from one line into one of the other lines by a "pick-up" pump. But in the case of a single line this cannot be done, and one pipe line company has found it practical to displace the oil by forcing compressed air into the line under 150 pounds pressure at a high point on one side of the drainage area. A portable air compressor is used for this work. The oil is forced ahead to the next station. This method of draining trunk lines was used satisfactorily recently for moving a line outside the limits of a refinery which had been built over the



Newly laid pipe lines are tested with compressed air supplied by portable air compressors.

pipe line, and in another case for replacing pipe in a creek which was the source of water supply for a town. In both cases, it was necessary that the line have little or no drainage oil in it. In the former case, 1,800 bbls. of oil was forced out of the line and when the line was cut it was found that only 15 bbls. of oil remained in the line. In the latter case, 1,600 bbls. of oil was forced out of the drainage area and the line was found to be free of oil when cut. In both cases the compressor was run from 12 to 24 hours. In the use of this method for draining lines, one must give careful consideration to the topography of the country.

Obsolescence

Welding has become so universally used in the pipe line industry that it has brought about a large obsolescence in pipe line tools and fittings. Before welding came into use the pipe lines were screwed together either by hand tools or pipe-laying machines. Welding has made obsolete the following material and equipment:

1. Pipe-laying machines.
2. Such hand tools as large laying tongs.
3. Large stocks and dies for cutting threads.
4. Jacks and other hand laying tools.

Welding and the use of the tractors have made obsolete:

5. The calipers and carrying irons, which were used in the days of 20-foot lengths of screwed pipe for carrying the pipe into position.

Electrical and acetylene welding are used almost exclusively for fabricating manifolds and piping, and the following materials have become obsolete:

6. Cast iron flange unions and companion flanges.
7. Large cast iron tees.
8. Large sizes of cast iron ells.
9. All thread and close thread nipples and almost all classes of nipples in diameters of 8 inches and larger.
10. Large diameter reducing tees.

Forged steel hub flanges and short radius steel turns and forged steel tees are being used instead of the heavy cast iron fittings which have been listed above.

The new methods for making repairs to lines by electrical welding are making the following material obsolete:

11. Large diameter threaded couplings.
12. Heavy cast iron leak saddles and stuffing box clamps. For the temporary repairs lighter clamps made of steel are being used.

In pipe line warehouses one will find much evidence of the obsolescence which has been described above. Many of the companies have been holding this material believing that there will be a possible use for it some day—that day has gone and much of this material will have to be sold as junk. The accompanying pictures show some of the materials which have become obsolete through the use of welding.

Beside the many other operating advantages in the use of welding it will have simplified warehouse stocks considerably when the accumulated supplies of obsolete screwed fittings have been junked and moved from the pipe line warehouses.

Line Pipe

Only three years ago seamless and electrically welded pipe was first tried for oil trunk lines, and today this is the only kind of pipe specified for oil trunk lines. The lap welded pipe is obsolete. It is true that some lap welded pipe has been used in some of the recent trunk lines, but it is understood that prompt deliveries on seamless pipe could not be made and lap welded pipe was used instead. For trunk line service either the seamless or the electrically welded pipe is used. It is noteworthy, however, that the lap welded pipe, which the manufacturers have supplied during the last two years, has held up satisfactorily under the initial field tests. Until recently a lap welded line always showed up a lot of "split joints"; for this reason the lines were filled and tested with water. Today the seamless and welded lines are so reliable that it is customary to fill the lines and test with oil.

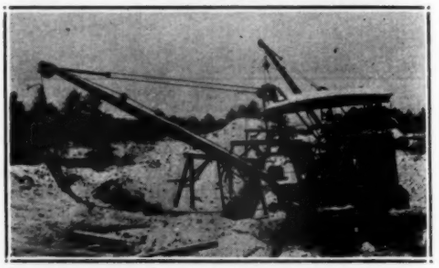
Pipe line engineers are divided in their opinions as to the use of the standard wall thickness or the thinner walls in pipe. Of course, this difference in opinions is based on the corrosion of the pipe. All of the engineers agree that the thinner walled pipe will take care of the operating pressure with a satisfactory factor of safety. Some engineers believe that the universal use of the thin-walled pipe will depend largely on the results that are obtained from the use of pipe line coatings. The lower investment cost in the thin-walled pipe is recognized but the opinion is held by some pipe line executives and engineers that the initial investment cost can be easily offset by loss in revenue or high operating costs if the thin-walled pipe should develop a higher rate of corrosion failures than the pipe of standard walls. It is reasonable to believe, however, that all pipe line engineers will not only recognize the economy in, but also the practicability of, the use of thin-walled pipe in the low-pressure end of the line.

The pipe line industry is using an appreciable amount of light weight pipe which is fabricated from toncan metal sheets spirally wrapped with interlocking and electrically welded seams. This pipe is coming into use for field gathering systems because of its weight.

Second-hand threaded pipe and the screwed coupling is still used in diameters up to 8 inches for field gathering systems. The continued use of this class of pipe is due to the fact that the pipe line companies have a supply of it in their warehouse stock and it is economy to use it. In time a light-weight pipe, using a flexible and easily assembled coupling, will replace the standard weight threaded pipe and screwed coupling.

Pipe Line Joints

For trunk line work the screwed coupling has given way to the oxy-acetylene or electrically welded joint. The beveled butt joint in standard wall pipe is welded by the oxy-acetylene method. Electrical welding has not been used satisfactorily on the straight butt joint without a "back-up" ring. Thus for electrically welded joints, beveled double-belled ends with a back-up ring fitted on the inside are used. The "back-up" ring in its different forms is used principally to obtain penetration with the electrical weld and to prevent "burning through" and to avoid the formation of "icicles." This ring



A special backfilling machine follows up and fills the trench.

has been adapted by different manufacturers to facilitate the lining up and the spacing of the pipe. The development of ductility along with high speed has brought the electrically welded joint into extensive use.

For field gathering systems the clamp or grooved type coupling with a rubber gasket is being used considerably. As the pipe line companies deplete their supply of second-hand screw pipe this type of

Tractors pulling old oil lines out of a river by heavy block and tackle.

coupling will find general use along with thin-walled pipe for field gathering systems.

Design of Oil Trunk Lines

In addition to the features which have been pointed out above, the present-day design for trunk lines specify mostly 10 and 12-inch seamless or electrically welded pipe. A few years ago 8-inch pipe was the popular size for oil trunk lines, especially for the high-pressure end of the line. In the seamless and electrically welded pipe line, engineers are specifying steel with an average of 60,000 pounds tensile strength. Until the last two years a 48,000-pound steel was used generally in pipe, primarily on account of the fact that the higher carbon steel could not be used for lap welded pipe. The higher tensile steel has proved satisfactory in the construction and the operation of the line.

The cost of transporting oil through a pipe line depends largely on the volume, and since there is a trend to the handling of large volumes through lines jointly owned by different companies and since for a given volume a single line is more economical than a double line there will probably be a trend to an extensive use of 12-inch pipe and in time we may expect the use of 14 or 16-inch pipe for trunk line service. This trend is possible through the development of high tensile steel either as seamless or electrically welded pipe. Until the last year or two the operating pressure on 10-inch pipe was kept at 600 pounds or below and for 12-inch pipe a pressure not to exceed 500 pounds. On the seamless and electrically welded 12-inch pipe, operating pressures

Leaking couplings and flanges in old lines are repaired by electrically welding swaged sleeves over them.

of 700 to 750 pounds are being carried without any operating troubles on account of the pressure.

Pipe Line Bridges

In the construction of gas lines, a bridge over rivers, creeks and ravines has come into use. It has been learned by experience that the maintenance of lines in rivers, creeks and across ravines is rather costly. This maintenance work is necessary on account of the corrosion of the line in such places, the pulling apart of the lines, and the lowering of lines on account of changes in channels or the erosion of creek or river banks. The pipe line companies owning lines across the Missouri River have lost their lines and some of the companies have suspended a spare line under one of the state highway bridges across this river. However, no great amount of trouble has been experienced with lines in the Mississippi River. On account of the high maintenance cost, the unreliability of lines buried in creeks and rivers, also the inaccessibility of the lines if repairs are necessary, the use of bridges for creeks and smaller rivers is being looked upon with considerable favor by pipe line engineers.

Pipe Line Pumping Stations

For trunk pipe line pumping stations, both Diesel engine driven reciprocating and motor driven centrifugal pumping installations have been made during the past year. The trend on pumping installations for main line service is not established. It is apparent that there is a definite effort on the part of the pipe line engineer to lower the initial investment in Diesel engine driven reciprocating pumping stations.

A new water cooling system for the Diesel engine pumping stations has been developed by one of the pipe line companies. Instead of having an open water cooling system consisting of expensive reservoirs, spray systems, etc., a closed system is used with a heat exchanger using the large volume of crude oil on the suction side of the discharge pump as the cooling medium. The principal advantages of this system are:

1. Only pure water is used in the closed system and scale in the engine jackets is avoided.
2. A large supply of water is unnecessary.
3. An expensive investment in reservoirs and cooling system is avoided.
4. The temperature of the cooling water can be regulated.

Recently an installation of a Diesel engine driven centrifugal pumping installation has been made by

Welding has made these heavy cast-iron fittings obsolete.

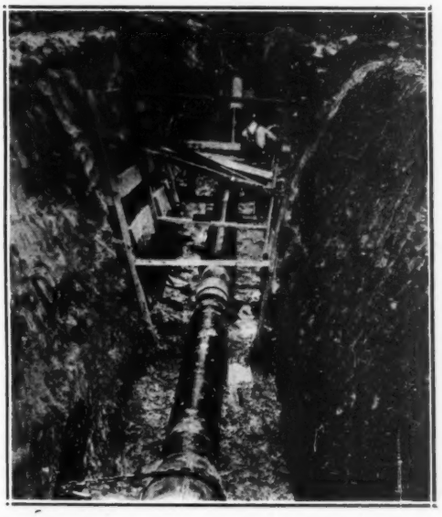
one of the pipe line companies. A gear box is used to increase the engine revolutions to drive the 1,750 r.p.m. centrifugal pump.

For field gathering pumping stations the trend has been definitely to the use of the motor driven pumping installations. In some of the installations in the large oil fields both motor driven centrifugal and motor driven reciprocating pumping installations have been made in the same station. The purpose of this dual installation is to have a large capacity in the centrifugal pump as a spare or for peak loads and the motor driven reciprocating pumping installation is used for the average load or for pumping the full capacity of the station after a two or three-year period when the field has passed peak conditions.

In recent motor driven centrifugal pumping installations, both for field gathering and trunk line stations, a speed of 3,600 r.p.m. has been used for both the pump and induction motor. Tests made on some of these high-speed installations have showed maximum efficiencies of 78 to 80 per cent on the pump. This increased efficiency on the centrifugal pump has been a development of the last year.

To offset the inroads made by electrical power companies in supplying power for the field gathering stations of the pipe line companies, the manufacturers of Diesel engines are offering to the industry a high-speed solid injection Diesel engine connected through a speed increaser to a centrifugal pump. Such a unit is mounted on steel I-beam skids. These units weigh between five and seven tons and are semiportable. The water cooling system is self-contained. The manufacturers are offering the high-speed engine in sizes (the speed depending on the size) from 100 horsepower up to 600 horsepower. Of course, the larger engines are not intended for semiportable installations; but the semiportable types have ratings from 100 to 365 horsepower. The engine is connected to a 3,600 r.p.m. centrifugal pump through a speed increaser. The centrifugal pump in these semiportable units have ratings up to 20,000 bbls. per day. This type of an installation may find an important use in the new "flush" oil fields.

The steam pump has been replaced largely by gas or gasoline motor driven engines connected by some type of belt to reciprocating pumps for gathering oil from leases in the large oil fields. The motor on such a unit is designed for 50 horsepower and the pump has a capacity of 4,000 to 5,000 bbls. per day at 150 pounds pressure. Natural gas is used in most cases for fuel. In such fields as Oklahoma City and Seminole, the large amount of oil cannot be handled through the gravity system during the development of the field and it is necessary to use the gravity system as "pump lines." The gas or



In cases of a large amount of oil drainage, corroded lines are encased with larger diameter pipe.

gasoline motor has replaced the steam pump first because it is more economical than paying 1 cent per barrel to the producer as "steam money," and in the second place the pipe line company avoids the inconvenience of obtaining steam from the pro-

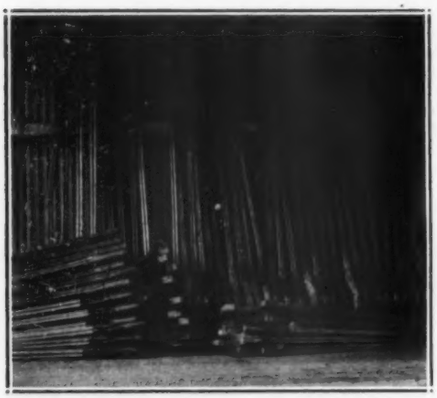
Gas or gasoline engine driven pumps have replaced the the steam pump in field gathering systems and the steam pump is almost obsolete for this service.

ducer, which is not always a reliable source of power. With the gas or gasoline engine, the pipe line company has its own independent source of power and can make its plans accordingly. The steam pump is used a little in the old settled fields, but in general it has become almost obsolete in oil pipe line work.

Small motor driven centrifugal pumps of capacities up to 12,000 bbls. per day and good for pressures up to 200 pounds have been used in the Oklahoma City Pool during the past year to take care of pro-

duction from some of the large wells; but this unit was found to be expensive on account of the electrical rate and it has yielded to the use of the gas or gasoline driven reciprocating pump.

Some of the features of the automatic station developed by a committee of the American Society of Mechanical Engineers have been incorporated in two trunk line stations and in semiautomatic field gathering stations. The various pipe line companies are trying out some of the automatic features and piece by piece the automatic station will be developed so that it can be used automatically; but the risks involved will not warrant such a station



Welding has made these hand laying tools almost obsolete.

being operated without an observer on duty. Through the co-operative effort of one of the large pipe line companies and one of the larger manufacturers of electrical equipment a remote supervisory visual control system has been developed to operate over a two-wire system. This system has been in service for two months and it is functioning satisfactorily. The semiautomatic station is coming into use, but the automatic station is still in the experimental stage.

A semiautomatic type of station is being used in some of the settled oil fields in conjunction with field gravity systems for gathering oil. For this type of service the semiautomatic station, involving such features as starting and shutting down on time, tank levels, high and low pressures, hot bearings, etc., will find continued use, especially when there is only a small investment in a station and a reasonable risk is warranted.

Metering Flow of Oil Through Pipe Lines

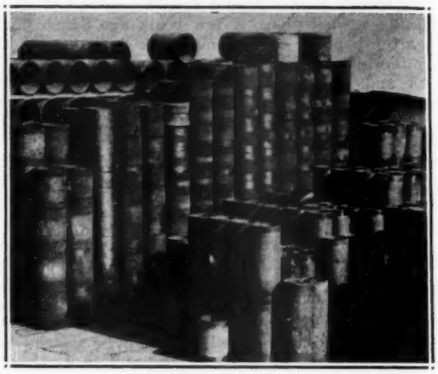
Ever since its beginning, the pipe line industry has measured oil receipts, deliveries and its hourly checks on the moving streams of oil through the pipe lines by tank gauges. This method has proved thoroughly reliable and practicable over a period of years, and actual tank gauges will continue to be used when oil passes ownership. But when ownership does not change, such as checking oil streams moving through a company's own pipe line, the oil meter could be used advantageously. One large pipe line company has been using a meter satisfactorily for checking the oil stream along its trunk line system. The industry has become accustomed to checking the oil streams in one way, and there has been little deviation from the established practice; but automatic tank gauging and the metering of oil streams through pipe lines are on the industry's program of developments during the next year or two. Already a subcommittee of fluid meters committee, American Society of Mechanical Engineers, has been appointed to make a special study of this problem.

Corrosion of Pipe Lines and Protective Coatings

Over a year ago the practice of reconditioning entire stretches of old pipe lines and applying coatings was abandoned, and the efforts of the pipe line companies were directed toward discovering the corrosive areas and reconditioning the lines in spots. This practice has continued through the past year. As an aid to carrying out a maintenance program, careful records of all corrosion failures on trunk lines are being kept by most companies in an effort to correlate the causes of corrosion. These records are beginning to show that oil leaks from pipe lines are in many cases the cause of corrosion. Until recently corrosion was generally attributed to "alkali" in the soil, but investigation shows that the other causes are in the majority. It is a record of the other causes, too numerous to name here, that is helping materially in combatting the corrosion of underground oil lines. The measurement of the flow of electrical currents on the pipe lines along with the measurement of the electrical resistance of soils is being used with some success in locating corrosive areas along pipe lines.

There is no agreement among pipe line engineers as to whether or not newly laid oil lines should be coated. Some long pipe lines have been laid during the past year without any coating. Others have been laid with coatings in areas which were believed to be corrosive. And still other trunk lines have been coated over their entire length. Some of the coated lines have been mill wrapped, and on other lines the coatings have been applied in the field. There are disadvantages in the use of both the mill wrapped and the field application.

There is no definite decision in the pipe line industry as to either the type of coating or the method of application and both remain undeveloped. The co-operative work of the Bureau of Standards, the American Gas Association and the American Petroleum Institute has already proved a great benefit to the respective industries in dealing with this problem, and the most recent results of their work promise some definite conclusions in the next two or three years.



These screw nipples have become obsolete on account of the established practice of welding in the pipe line industry.

For oil field gathering stations the electrical motor driven centrifugal and reciprocating pump is used extensively.

Transporting concrete which is placed in forms on pipe line for anchors—one-half yard each 20 feet—where the line is laid through swamps. Note the catwalk on the right for line walkers.

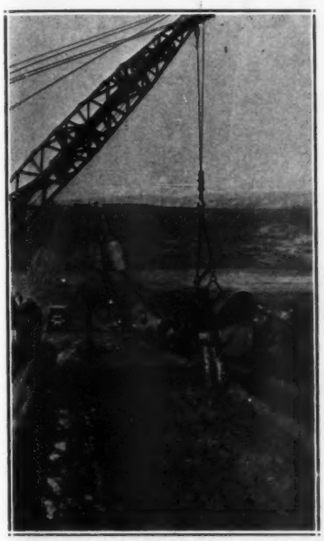
Trend of Construction in California

Natural Gas Engineers Inclined to Use Larger Diameter Pipe of High Tensile Strength Steel Which Permits Thinner Walls and Less Weight

By William Moehler, Jr.,
Vice President, Southern California Gas Co., in Charge of Natural Gas Production and Transmission

The need of providing additional supplies of natural gas from more distant fields to take care of the increasing demands of the larger California cities and to augment the declining supplies available from existing nearby fields presented a problem that led to the consideration of large diameter pipe lines.

Up to the time that lap welded pipe only was available for natural gas pipe lines, the natural gas engineer was limited as to pipe diameter, wall thickness, and specifications of the steel used in the manufacture of this pipe. These limitations were fixed by the manufacturer's ability to make this pipe.



On the firing line in South Kettleman Hills, California.

With the introduction of electric welded pipe, the natural gas engineer has been given greater latitude in specifications for natural gas transmission pipe line.

The engineer's responsibility is to produce the best job for the least cost, having in mind both investment and operating costs. With this in mind, the California natural gas engineers have been inclined to use larger diameter pipe made of higher tensile strength steel which permits thinner walls and corresponding lesser weight of material.

As evidence of this trend, when the initial Kettleman Hills-San Francisco project was installed, 20-inch outside diameter electric welded pipe was used. This pipe was made of 20-30 carbon steel having a tensile strength of 68,000 pounds and an elastic limit of 34,000 pounds. The working fiber stress was considered as 17,000 pounds, which indicated a factor of safety of 4, compared with the ultimate strength of the steel. Following this installation, considerable mileage of new transmission mains was installed both to San Francisco and to Los Angeles in which 22-inch, 24-inch and 26-inch outside diameter electric weld steel pipe was used. This pipe also was made of steel having the same general specifications above stated. Obviously, this design effected considerable economy over the older practice of using steel of lower tensile strength which permitted a safe working fiber stress of only 10,000 or 12,000 pounds per square inch.

Engineers Favor Solid Welding

The California natural gas engineers are practically in agreement on the matter of solid welding of natural gas transmission lines for use in the Pacific Coast territory. This policy of welding long transmission lines throughout without the use of rubber packed pipe couplers is justified by the successful experience with this type of construction on the Pacific Coast over a period of 10 years or more. Our first welded lines were installed as early as 1915.

With the higher carbon (20-30) steel pipe, it was necessary to improve methods and materials used in field welding, and this was readily done. While acetylene gas welding was the general practice with the lower carbon steel pipe, the introduction of the higher carbon pipe brought also our first extensive use of electric field welding, and the results have been so universally satisfactory that electric field welding for larger diameter thin wall pipe has found favor with most Pacific Coast engineers. The greater speed in electric field welding influenced its use rather than any inherent weakness in gas welding.

Recent improvements in gas welding may again change this trend.

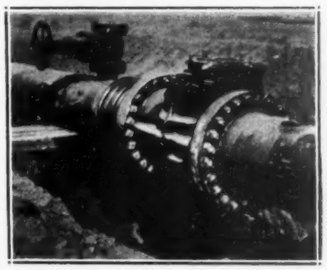
A maximum working pressure of 400 pounds has been adopted generally for natural gas transmission lines of any length—in fact, this pressure was used on the original Midway 12-inch main line from Taft to Los Angeles as early as 1914 and has since been used as maximum pressure on all of the major trunk pipe lines.

The tendency of Pacific Coast engineers is to use larger diameter pipe rather than higher pressures. Local conditions must govern each case, however. In the case of the recently installed large diameter transmission lines from Kettleman Hills Field to both San Francisco and Los Angeles, the gas was made available to the pipe line company under a field pressure of 400 pounds. It was estimated that this pressure would be available without field compression for a considerable number of years. This is casing gas produced by oil wells under well pressures considerably in excess of 400 pounds, but the oil producers and gasoline extraction plants in this field so designed and installed their field equipment, collecting lines and gasoline plants that this casing-head gas production could be handled at pressures up to about 450 pounds. In the design of these various transmission projects, 400 pounds was therefore considered as the maximum initial pressure and knowing the capacity desired for each project, the necessary pipe diameter was determined. This resulted in pipe lines ranging from 20-inch outside diameter to as large as 26-inch outside diameter. Had the initial required capacity of any of these projects called for pipe diameters larger than 26-inch outside diameter, we would undoubtedly have been in the market for such larger diameter pipe.

Minimum Wall Thickness

In the design of these large diameter pipe lines, we have considered one-fourth-inch as the minimum wall thickness, primarily because we are not certain about the efficiency of present day pipe protective coatings. In other words, we are not willing to install larger diameter pipe lines of wall thickness less than one-fourth-inch with the best protective coatings available today.

Obviously, with this limitation of one-fourth-inch minimum wall thickness, a pipe of about 20-inch diameter or less would be quite suitable for 400 pounds working pressure if made of 20-30 carbon steel having an ultimate tensile strength of about 68,000 pounds and elastic limit of 34,000 pounds. However, for larger diameters or higher pressures, it would be desirable to use pipe made of steel having a higher ultimate tensile strength and elastic limit in order to save weight—assuming, of course, that this product has no other objectionable fea-



Typical installation of 22-inch main line Venturi type lubricated cock with 6-inch blowoff valves on either side. No by-pass required.

ENGINEERS CONCUR IN VIEWS

While Mr. Moehler is regarded throughout the natural gas industry as one of its best and most progressive engineers, he was desirous of obtaining a cross-section of opinion from California engineers regarding views expressed in the accompanying article. He sent this article for review and criticism to A. F. Bridge, vice president in charge of operations of the Southern Counties Gas Co.; Ray Fuller, engineer of distribution of the Pacific Gas & Electric Co.; and H. P. George of the Southern Fuel Co. Hence, the article really represents the views of four prominent California natural gas engineers.—A. M. R.

Rights of way were graded in the Southern California Gas Co.'s 22-inch line from Kettleman Hills to Los Angeles to facilitate use of long joints and to speed up construction.

Why pay MORE *for work that* Compressed Air *does for* LESS?

Use cup grinders to smooth pipe cut by torches.

Use rotary wire brush to clean rust and temporary compounds off pipe before painting.

Spray permanent coats of paint on pipe.

Take pipe cleaning, for instance. Two men and one air compressor can do more work, and better work, than a crew of 10 to 14 men. The savings in labor amount to $40 to $50 per day.

Men formerly cleaned pipe by hand only because it was considered impractical to drag a heavy water-cooled trailer-mounted compressor along a pipe line right-of-way behind a tractor.

Since the 142 cu. ft. air-cooled Davey Compressor weighs only 1000 lbs. complete, it rides *on* the tractor instead of being dragged *behind* it. It makes the use of compressed air entirely practical for pipe cleaning, for pipe spraying, and for many other operations that would otherwise have to be done mainly by hand labor.

Successful pipe line contractors such as Williams Brothers, Oklahoma Contracting, Henry Lemons, etc., use and approve Davey Compressors. They have found the Davey Compressor a time-and-money-saver, and fully dependable even in the rough service under which pipe line construction equipment must operate.

"Air cooling" assures more dependable operation because of the absence of complicated and bulky parts needed for water cooling. Finned aluminum alloy cylinder heads and manifold take the place of cast iron cylinder jackets, radiator hose, piping and big radiators. Simple, rugged design, with fewer parts and stronger parts.

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carbon removal, makes certain that your compressor will always deliver full pressure and volume of air.

Get the complete story of savings on pipe line jobs with "Caterpillar"- mounted Davey Compressors. We will also tell you where you may see a Davey Compressor near you. Use the coupon below:

Fell trees along right-of-way with air-driven chain saw. (Same tractor then skids trees off to one side of right-of-way.)

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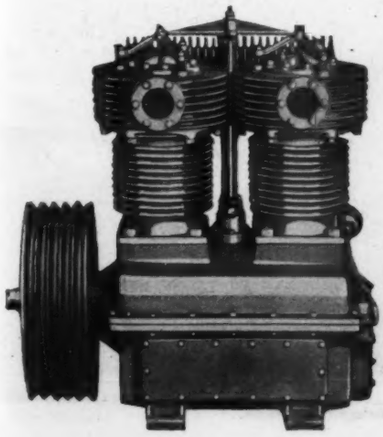
The method of cooling air compressors through the use of metals of high heat conducting quality and capacity, as contained in Davey Compressors, is fully protected by patent.

Operate jack hammers and other percussion tools for removing shale, rock or highway pavement.



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tures and can be obtained at approximately the same price per pound.

In each project the pipe diameter used was sufficient to provide the immediate required capacity with 400 pounds initial pressure and no subsequent re-compression along the transmission line for a period of several years. However, the design of these projects provided that the capacity could be increased subsequently if necessary by the installation of one or more main line booster stations, maintaining 400 pounds as the maximum discharge pressure from each booster station, and operating each booster station with a compression ratio of about two or less.

Construction of a 26-inch main transmission line in the outskirts of Los Angeles.

This procedure results in the most economical project for the immediate required capacity for which a market exists and for which the gas is available, and provides for increasing the capacity in an economical manner considering the fact that the increased requirements are anticipated in the future, but there is no definite assurance at present that sufficient gas will be available in the future to meet this requirement.

Design of Latest Project

In the most recent pipe line project in California, a 26-inch outside diameter pipe line was designed for 400 pounds maximum working pressure in the field and at the discharge of prospective main line booster plants to be subsequently added as and when needed. Consideration was given to the use of steel pipe for the higher pressure sections made of steel having higher ultimate tensile strength than that heretofore used. Investigation and tests led to the decision to specify for part of the line, pipe made from 35-45 carbon steel having an ultimate tensile strength of about 80,000 pounds elastic limit of about 40,000 pounds for which we figured a safe working stress of 20,500 pounds per square inch.

Our preliminary tests of pipe made from this class of steel indicated that it could be welded readily in the field, with present acetylene or electric welding methods and materials and that it was in every way suitable for a large diameter transmission pipe line.

Because of the relatively great cost of large diameter pipe lines of 20 inches and over, it has been our experience that the careful selection of the route to obtain the shortest length even in very rough or mountainous country is fully justified. It usually pays to build roads and make the right of way accessible rather than follow a longer route which is more accessible at the outset.

We have found it advantageous to grade the right of way in rough country so as to permit the use of 40-foot joints. Where hauling conditions permit their distribution along the right of way, we would use 60-foot lengths and have recently specified this length made up by welding two 30-foot joints together in the shop of the manufacturer before shipment.

Centering Rings Specified

Based on our construction experience with large diameter pipe lines, say 20-inch and over, suitable centering rings are now specified for all field welding. The use of these rings insures better alignment in the field and materially speeds up construction work. The rings must be sufficiently rigid to accomplish this purpose and must be properly designed for the particular type of field welding to be used—that is, acetylene gas or electric. Centering rings may be used with either plain end pipe, or with double bell end pipe, with preference for the latter, because it appears that the bell ends are somewhat more rigid and have a tendency to maintain roundness. Furthermore, while plain end and double bell end pipe can be straight butt welded in the field, the latter has the further advantage that where necessary or convenient, it is possible to make a bell and spigot type joint.

In all our large diameter pipe lines, angles or bends are made by welding shop angles or bends into the line rather than to use the so-called fire bends or cold bends made in the field. Straight butt welds are used rather than miter welds wherever possible. If miter welds are made, proper reinforcing is added.

As already stated, all major transmission lines in California are solid welded and no trouble has been experienced by following this practice. Care is taken during construction to prevent undue tension strain in the line. All sections are tied together during the coolest time of the day or night, the trench is backfilled during this period and slack is provided by proper lowering in. In cases where the line is subjected to extreme temperature changes such as long exposed bridge crossings, etc., the line strain is sometimes taken care of by means of offset bends, but quite frequently welded up solid if the maximum stress due to temperature does not exceed 7,500 pounds per square inch.

Pressure Limiting Stations

In the design of a recent 26-inch line 210 miles long, a graduated wall thickness of pipe was used corresponding to the pressure gradient. Allowance was made for the future location of main line booster stations. In this case we were able to assume that gas would always flow in one definite direction throughout the operative life of this line. The minimum wall being one-fourth-inch thick, the thickness was increased in steps of one-thirty-second inch. This practice requires the installation of pressure limiting stations at each point where the wall thickness is reduced. In our case the cost of these stations was quite small compared to the large savings in tonnage of pipe.

The selection of the best type of main line shutoff valves has always given us much concern. Emergency repairs can be made quickly by means of field welding, provided a positive shutoff can be made at any main line valve. Our experience in the past with gate valves for this service has not been entirely satisfactory and led to the use of lubricated plug cocks. While our experience with these has been limited, the service to date has been very satisfactory. The cost is considerably above that of gate valves and the tendency is toward gate valves provided continued improvement in design and construction will insure more satisfactory service than we have experienced in the past.

Tractor pulling pipe into place ready for welding.

For convenience and safety in operations, main line valves are generally installed at intervals of 5 miles.

For all large diameter transmission lines, it is now general practice to use main line valves having an open area of approximately 50 per cent of the internal cross-section area of the pipe line. Both Venturi type valves and straight valves fitted with steel Venturi nipples are being used.

While semisteel valves and fittings have been used in the past for working pressures up to 500 pounds, the tendency is toward the use of steel valves and fittings for large diameter pipe lines, which have the advantage of being made of a material having characteristics similar to the material of which the pipe is made. Steel valves and fittings should be better adapted to withstand line strains which may be imposed upon them. Our experience tends to indicate the need of protecting semisteel valves and fittings in large diameter pipe lines against excessive line stress by the use of some form of expansion joint placed in the line next to such valve or fitting.

Rough going on the 22-inch line over the Tehachapi Mountains.

Valves *for pipe lines*

KENNEDY Valves for oil, natural gas and gasoline pipe lines can be thoroughly depended upon for strength, ease of operation, and economy of maintenance.

These valves are amply strong because of their heavy proportions, carefully selected metal for all parts, and the absence of sharp curves in bodies or bonnets, thereby eliminating chances of weakness at these points.

Each valve is hydraulically tested to far above its rated pressure.

Ease of operation is assured by the special double-disc parallel-seat design with unusually large seating surface and guided discs. The operating mechanisms close tightly, release promptly, and will not stick or bind, and the large hand wheel provides ample leverage for operation.

The economy of maintenance of these valves is proven by the service records of the many thousands in use. Their ruggedness and simplicity enable them to withstand severe service on the one hand and on the other hand provides quick response after long periods of idleness.

Kennedy Valves for the petroleum and natural gasoline industry include 1600-lb. test, 1000-lb. test, and 700-lb. test iron-body bronze-mounted and all-iron types, together with a large variety of other types for higher and lower pressures, malleable iron screwed pipe fittings, and standard cast iron flanged fittings and flanges.

The Kennedy Valve Mfg. Co., Elmira, N. Y.

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Because The Barrett Company maintains absolute control over every step in the process of manufacturing the various Barrett Specification Pipe Line Enamels *any* order can be *exactly* duplicated at *any* time. From selection of the crude to finished product, each batch is tested at each stage of manufacture. Specially trained chemists, with the most modern laboratory equipment, make certain that the finished enamel is exactly as specified. Every drum is identified. Exact data is kept on each shipment.

Technical assistance on any problem of pipe line protection is available upon request, without obligation.

The Barrett Company

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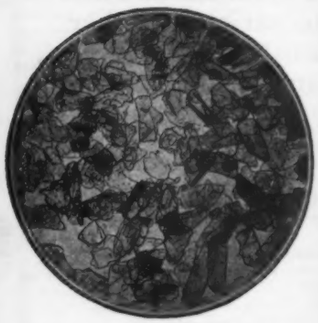


Photo-micrograph shows how flakes of internal reinforcement used by Barrett tend to interlock. They laminate with water-proofing agent and give Barrett Pipe Line Enamel unusual tensile strength and toughness.

For pipe of large diameter The Barrett Company will furnish equipment required to revolve pipe and spread enamel.

Ju

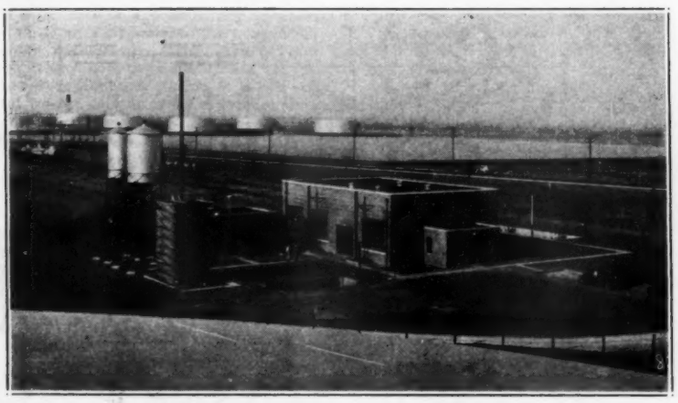
East Interested in Gasoline Pipe Lines

Rapid Development of This Form of Transportation Expected to Supplement Extensive Marine Distributing Organizations

By A. E. Mockler
New York Bureau, The Oil and Gas Journal

Eastern oil companies are watching with close interest the development of pipe line gasoline distributing systems in various parts of the country, notably the South and Middle West areas. Future development of marketing structures in the East will employ gasoline carriers of this type as a supplement to the extensive marine distributing organizations built up by the various companies.

While the idea for lengthy gasoline pipe lines originated in the East, with Standard Oil Co. (New Jersey) taking the leadership in this development through conversion of the old Tuscarora crude oil pipe line to a gasoline carrier, with reversal of flow from west to east to east to west, construction of new pumping stations, bulk storage, etc., the most extensive developments in this direction thus far have come from the Mid-Continent area, with several transmission lines built and projected for the carrying of gasoline to distant distributing centers.



Ponca City pumping station of the Great Lakes gasoline line.

The Tuscarora line has been operating for more than a year as a gasoline carrier, and transmission of gasoline from the Bayway and Bayonne refineries of Standard Oil Co. (New Jersey) has substantially broadened the company's marketing operations, particularly in Pennsylvania, where Standard Oil Co. of Pennsylvania, a subsidiary company organized a few years ago, has steadily forged to the front as a major marketer of motor fuel, lubs and other refined products.

Sun Constructs Long Line

Conversion of the Tuscarora line to gasoline carrying was followed by an announcement last year that Sun Oil Co. would undertake the construction of an extensive gasoline pipe line system in the East, and the first links of this system are now carrying gasoline. The Sun pipe line system connects Cleveland, Syracuse and Pittsburgh with the company's refinery terminal at Marcus Hook, just outside of Philadelphia, and is expected to be completed soon.

The western section of the Sun line has been completed as far west as Pittsburgh, and gasoline is now being delivered to that city. This section of the line will ultimately extend to Cleveland and other Ohio points.

The eastern section of the Sun line, running to Syracuse, has been completed to the Pennsylvania-New York State border, a distance of about 200 miles. Contracts have been let for the remaining 100 miles of this line, and the company will have an extensive bulk terminal system at Syracuse, which is on the New York State Barge Canal.

Sun Pipe Line, Inc., subsidiary of Sun Oil Co., is building the New York State section of the line, the balance being built under the direction of the Susquehanna Pipe Line Co., which is affiliated with Sun Oil. The entire Sun gasoline pipe line project involves the expenditure of between $5,000,000 and $6,000,000, and completion of the system will mark a substantial broadening of the company's marketing activities.

Atlantic Building Line

The Atlantic Refining Co. is planning the construction of gasoline pipe lines to cover important distribution centers in Pennsylvania. The Keystone Pipe Line Co., a Pennsylvania corporation, wholly owned by officers of the Atlantic Refining Co., has been incorporated for this purpose.

The first line will extend from the company's refinery in Philadelphia to Harrisburg and Scranton and then to the New York-Pennsylvania State line. Another line may run to Pittsburgh and Franklin, Pa., where the Atlantic also has refineries.

Completion of the Atlantic Refining Co.'s gasoline pipe line construction project will knit together its refineries at Point Breeze, Pittsburgh and Franklin, and thoroughly consolidate its gasoline distributing system in the important eastern marketing territory which the company serves.

The Standard Oil Co. of New York will build a gasoline pipe line to connect its tidewater bulk terminal at Providence with Worcester and Springfield, Mass., with bulk stations planned at intermediary points along the line.

Others Considering Lines

While other eastern oil companies have not yet announced any plans for gasoline pipe line construction, it is known that a number of companies have projects of this type under consideration, and it is probable that additional announcements of this kind will be made in the near future.

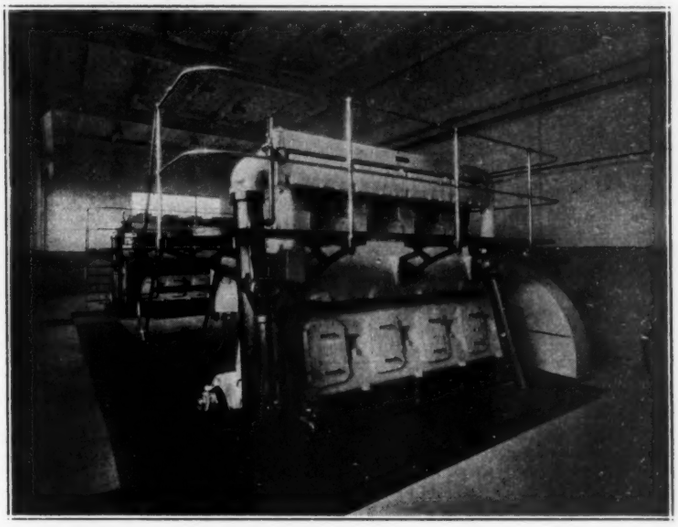
A number of the eastern companies, it is indicated, are considering the question of gasoline pipe lines to hook up with their marine marketing operations, marine distribution having received considerable impetus in the East during the past few years.

There has been a considerable program of small tanker construction on the part of major eastern companies during the past few years, and large quantities of motor fuel formerly moved by tank car are now being transported by water.

Distribution by Water

More important still, however, as marking an innovation in marketing practices has been the material expansion in gasoline distribution by river and canal barge. These barges, self propelled and in many instances powered by Diesel-electric drive, are now a familiar sight on eastern inland waterways. Regular gasoline barge movement is witnessed throughout eastern rivers, Long Island Sound (serving New York, Connecticut, Rhode Island) and a steadily growing movement of gasoline is also being recorded on the New York State Barge Canal system.

Reconstruction of the Tuscarora pipe line as a gasoline carrier last year by Standard Oil Co. (New Jersey) was part of an expansion program by that company which involved the placing of a considerable fleet of gasoline barges on the Allegheny, Ohio and Mississippi Rivers, and the company has established a large waterfront bulk terminal at Pittsburgh, supplied by the Tuscarora line.



Interior view of Ponca City station of the Great Lakes Pipe Line Co.'s gasoline line.

Development of waterways distribution of gasoline has necessitated the evolvement of an entirely new type of tanker. These carriers are extremely low in the water and many of them (particularly the barge type) are largely submerged, only the slight superstructure showing. The vessels are built without masts or high superstructures, no part of the

New type of barge developed for transportation of gasoline by water, supplementing pipe line service. The barges shown in picture are 150 feet long by 35 feet wide with depth of 10 feet 3 inches. Each has a capacity of 7,000 bbls., which is the equivalent of an ordinary train load of tank cars. Each barge is equipped with rotary pumps and a gasoline driven engine capable of propelling the barge. Smaller barges have been built for use on shallower streams. They are 140 feet long, 26 feet wide and 9 feet 6 inches deep and have a capacity of 4,500 bbls.

tanker, in most instances, reaching more than 15 feet above the water line. Sun Oil Co. is operating several model barges of this type, outstanding of which are the Seneca Sun and the Cayuga Sun, used in the New York State Barge Canal system. These tankers are each 197 feet long, with 31-foot beam, and normally draw 9 feet of water. The dimensions of these vessels are within the limits of most eastern waterways and have carrying capacity for more than 250,000 gallons of gasoline. These vessels, however, are larger than the average canal tanker, and can, on occasion, be used for deep-water work, one of these vessels last year running successfully from Philadelphia to Chicago.

Bulk Station Expansion

Extension of canal and river shipment of gasoline in the East has been paralleled by an extensive program of bulk station construction, and a logical step (and one which is receiving serious consideration in some quarters) is the linking up of these new bulk terminal stations with adjacent marketing centers by short gasoline pipe lines. In many instances, it is said, construction of short pipe lines of this character will prove more economical than the movement of gasoline from the waterfront stations via tank car or motor truck.

In addition to the development of pipe line and marine distributing facilities entering in the East, it is expected that the development in barge shipments of gasoline and other refined products will open up Detroit, Chicago and other Great Lakes markets to East Coast refiners, who will thus enter into more direct competition with Group 3 refiners.

Improvement in eastern waterways has led to the formulation of plans for an extensive network of barge lines to connect midwestern manufacturing centers, situated close to the Great Lakes, with New York. Under the plans of the sponsors of these lines, steel and other manufactured products will be shipped by barge to New York, Boston and Philadelphia. These barges, after delivering their freight cargoes at Atlantic Coast ports, will take on fuel oil, gasoline, ucts for the return voyage. Heavy shipments of bulk fuel oil will be made in this fashion, it is reported, the barges lubricating oils and other petroleum prodbeing particularly constructed with a view to carrying bulk oil shipments as ballast on their return journeys.

While Standard of New Jersey, Sun, Atlantic and Socony have taken the lead in gasoline pipe line development in the East, all of the major integrated companies have been active in building up marine distributing fleets and facilities, and it is not expected that these other companies will be long in following the lead of the above named companies in developing pipe line distribution.

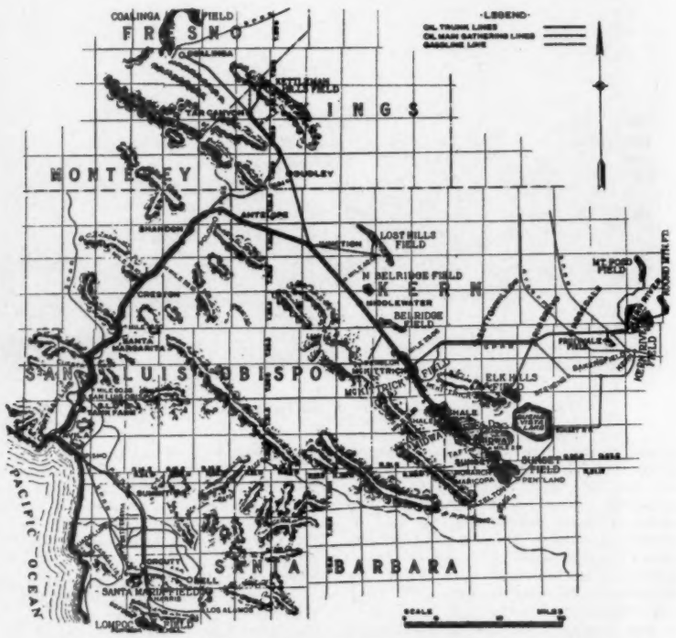
Railroad Agitation

Uncertainty regarding the outcome of the agitation of railroad interests for stringent regulation of pipe lines by the Interstate Commerce Commission, it is believed, is responsible for the relatively slow progress made by gasoline pipe lines during the past few months, and it is thought that a number of other companies, which have been investigating thoroughly the possibilities offered by pipe line distribution of motor fuel, are withholding definite formulation of plans along this line until the situation brought about by the recent demand of railroad executives has been settled.

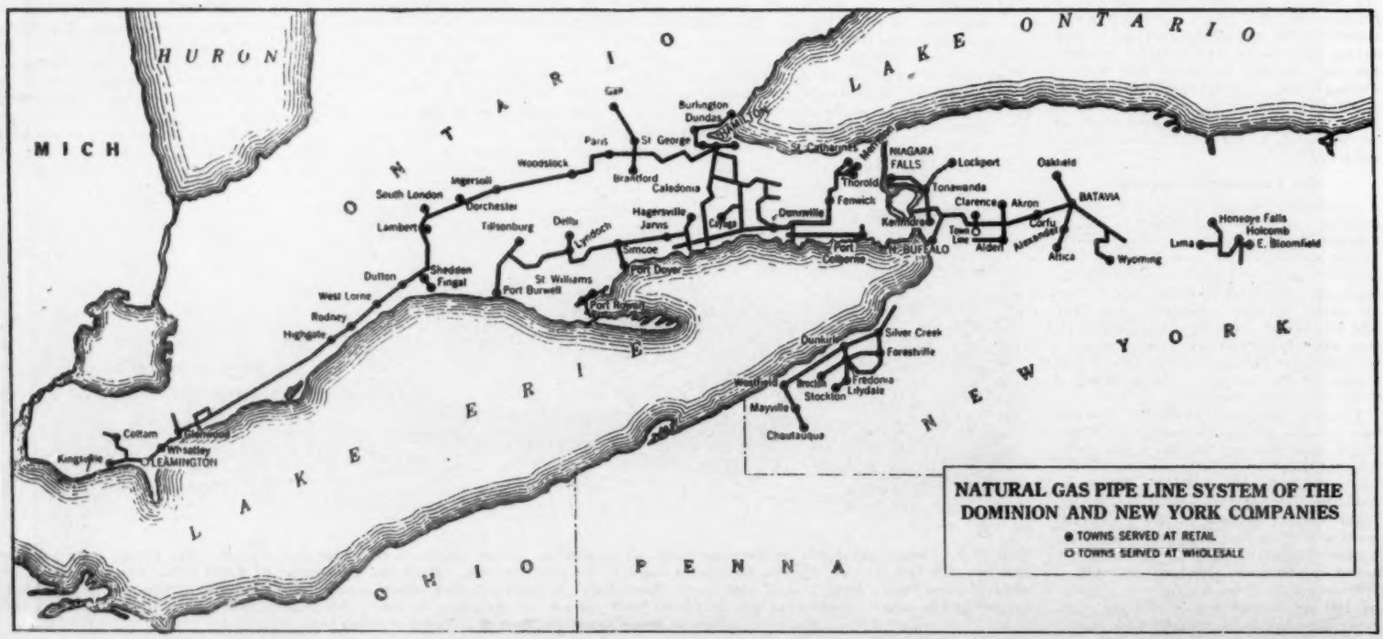
While construction of gasoline pipe lines in the East will involve a heavier outlay than similar construction in the Southwest and Middle West, owing to the nature of the territory to be traversed, it is believed that the economies offered by this type of transportation more than counterbalances the higher initial costs, and that a pronounced trend toward gasoline pipeline distribution is in sight for the Atlantic Seaboard territory.

A number of the large companies which have previously centered their marketing operations in seaboard cities of heavy consumption are now showing more interest in southeastern markets. New bulk stations have been opened at southern ports, and marketers are gradually penetrating to inland markets, shipping by tank car and tank truck. Gasoline pipe lines in this area offer many interesting possibilities to large marketers, and construction of pipe lines in the southeastern territory would not involve the heavy expenditures necessitated by lines in New York and the New England states, where such lines would cross little open country, and would require special construction to pass through or around the many towns and cities. Additional consumption possibilities in this area, however, tend in turn to counterbalance these higher construction costs.

Manifold of the Barnsdall station of the Great Lakes Pipe Line Co.'s gasoline line.



Map showing Union Oil Co.'s gasoline line.



California Gasoline Pumping Methods

Combination of Centrifugal Pumps and Steam Turbines Makes for Flexible Unit and Permits a Closed System Operation

By Harold H. Yackey
Mechanical Engineer, Transportation Department, Union Oil Co. of California*

During the past year the Union Oil Co. of California completed a 6-inch pipe line with pumping equipment and tankage for transporting gasoline from Tar Canyon pump station to storage tanks at Avila.

A 6-inch gathering line connecting Tar Canyon station with Kettleman Hills was previously installed. From the storage tanks at Avila to the tanker loading berths off No. 2 Wharf at Port San Luis, a 16-inch gravity line approximately 9,000 feet long was laid.

From Tar Canyon station the new line parallels the company's original line from Coalinga to Junction for about 8.5 miles; thence it runs through Cottonwood Pass for a distance of approximately 18 miles to Cholame Flats. From there, approximately 4.5 miles east of Shandon station, it parallels the other Union Oil Co. lines from Junction station to Avila, except that it goes around the town of San Luis Obispo instead of traversing it as the other lines do.

The main line of 6⅝-inch outside diameter pipe was acetylene and oxygen welded, and averaged 18.209 pounds to the foot and 42 feet 10 inches to the joint. The line was suspended across the San Juan River and encased in an 8-inch pipe across the Salinas River, the 8-inch pipe being trenched into the rocky river bed.

Block Valves Installed

Since the line passes through Shandon, Creston and Santa Margarita stations, block valves are installed in the line at both sides of each station, and also at critical points such as the foot of Cottonwood Pass, Cuesta Grade, and on both sides of the earthquake fault across the Cholame Flats. These valves which are 2,000 pounds tested gates make it possible to block off sections of the line in case of a pipe line break.

Pumping equipment has been installed at Tar Canyon and Shandon stations to deliver a maximum of 15,600 bbls. per day to Avila, and by the addition of booster pumps at the approach to Cottonwood Pass and at Creston and Santa Margarita stations, the capacity can be increased to approximately 25,000 bbls. per day.

The pumping equipment chosen for the present installations consists of multi-stage centrifugal pumps direct connected to variable speed steam turbines. A great deal of care was given to the selection of the pumps, which are especially built for heavy duty continuous operation; and to the choice of variable speed steam turbines which maintain a low steam rate per horsepower hour over a wide range of speeds. These turbines have working governors controlling a series of nozzle chamber valves which automatically operate the turbines at five different speeds without throttling steam.

Never Goes into Tank

This combination of centrifugal pumps and steam turbines makes for a very flexible unit and permits closed system operation. The high vapor pressure natural gasoline now being pumped is carried from the field to the coast without ever going into a tank. This not only prevents losses from evaporation, but permits the stations pumping to utilize any suction pressure that is available from a preceding pumping. Static head is likewise utilized to full advantage.

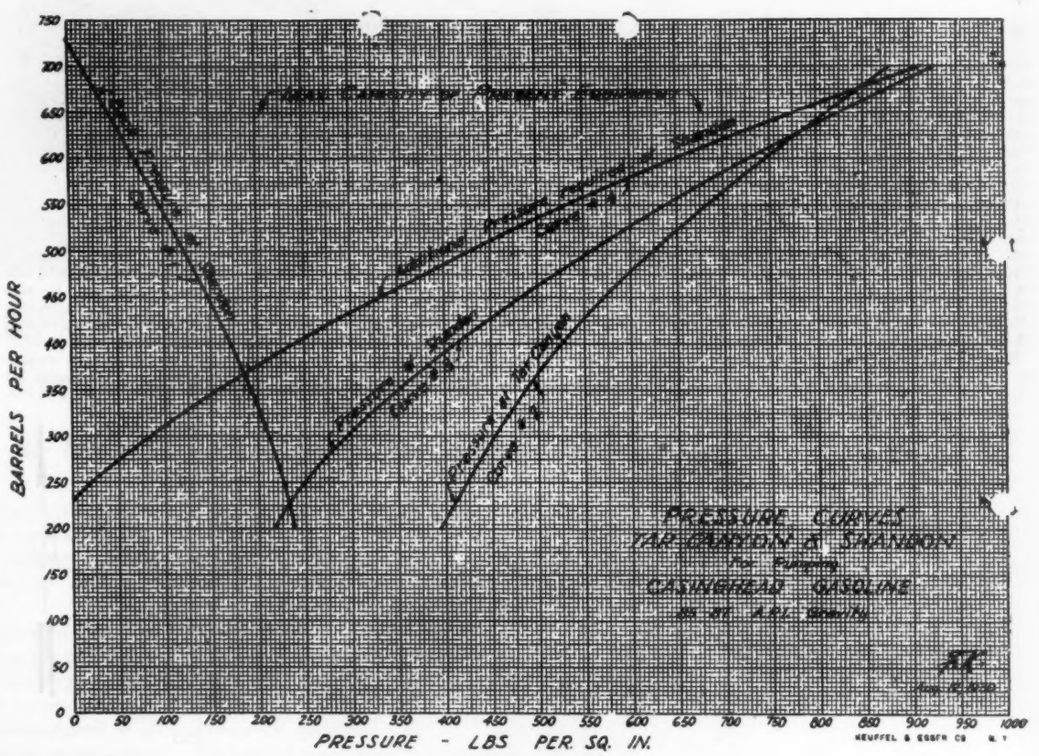
The accompanying chart shows the pressures necessary at Tar Canyon and Shandon stations to give any pumping rate up to the maximum capacity of the present equipment. The "back pressure at Shandon" line shows the available head from Cottonwood Pass at any pumping rate. This pressure is at a maximum when there is no flow in the line, and as the flow increases, the static head is gradually taken up by the frictional resistance in the line from the summit of the pass to the pump.

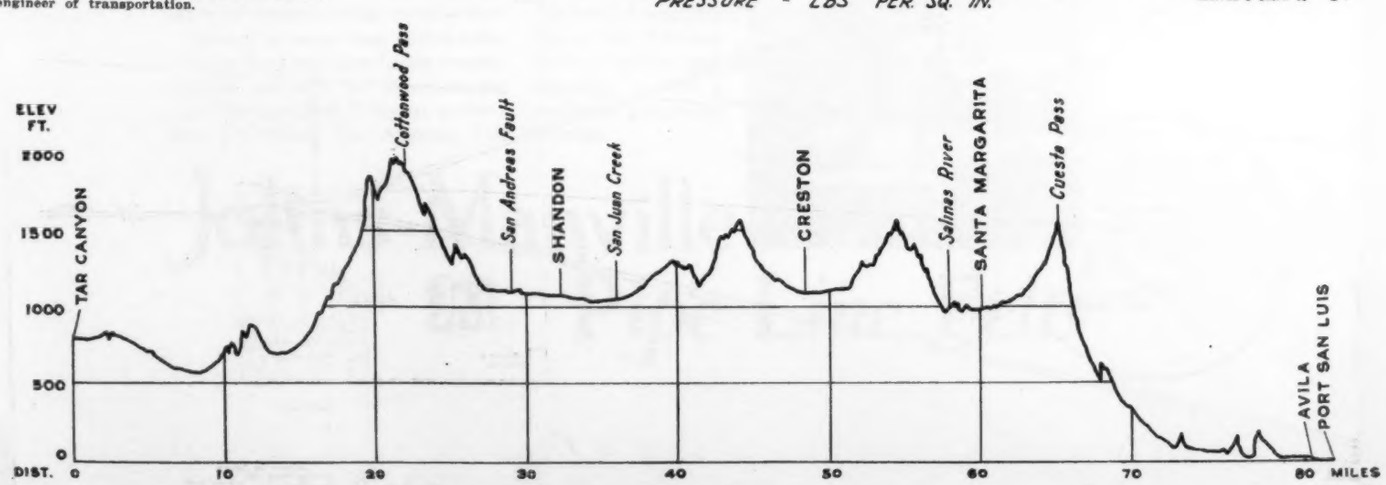
At Tar Canyon station two 4-inch six-stage pumps, each driven by a 300-horsepower, 3,800 r.p.m. turbine, were installed, one as a standby. At Shandon station one 4-inch six-stage pump with 300-horsepower, 3,500 r.p.m. turbine and one 3-inch four-stage pump with 65-horsepower, 3,500 r.p.m. turbine were installed.

By utilizing the field pump pressure and by-passing Tar Canyon station, the smaller pump at Shandon will deliver up to 10,000 bbls. per day. This smaller pump is also used as a standby to the larger pump, which has interchangeable parts with the two at Tar Canyon.

The entire gasoline system from end to end is designed so as to make operation as simple, flexible and economical as possible.

*Prepared under direction of Fritz Karge, engineer of transportation.





Profile of Union's gasoline line from Tar Canyon to Port San Luis.

Ajax Pipe Line Contains Unique Features

Station Arrangement Permits Pumping Different Oils at Same Time Without Contamination. Can Transport Gasoline and Crude

By Robert C. Conine

Something really new in pipe lines. An arrangement which permits the pumping of different crude oils at the same time without mutual contamination from Glenn Pool, directly south of Tulsa and east of Sapulpa, to Woodriver, Ill., which assures continued operation when a break in a line would halt work in an ordinary system, and which, with minor changes, could be used for transporting gasoline along with a crude shipment. Such is the Ajax Pipe Line Co.'s system.

It should be noted that all of these advantages are not at this writing available, but their realization involves only the matter of a few additional working tanks and minor hookups such as are already installed at two of the pump stations. These changes would be required at eight stations.

Few could refrain from wondering what was going on when the Ajax, with headquarters in Springfield, Mo., on June 25, 1930, started the construction of a 10-inch twin pipe line from Glenn Pool to Woodriver. There was no precedent for such a project so developments were watched with interest until November 25, when the line was completed, and December 4, when the first consignment of crude oil from Oklahoma reached the Illinois station over the 394-mile right of way of the duplex system. Moving at a rate of 2.75 miles an hour, with 510 bbls., approximately, to the mile in each line, more than 65,000 bbls. of crude oil could be delivered daily through the twin pipes, providing a sufficient answer to the "why" of a twin line. More and weighty reasons for such a construction will become evident as a closer view is taken of the Ajax Pipe Line Co.'s project.

Following the system we start with the pump station at Glenn Pool and moving north and to the east we come successively to the following stations: Pryor, Okla.; Afton, Okla.; Racine, Mo.; Stotts City, Mo.; Springfield, Mo.; Lebanon, Mo.; Dixon, Mo.; Owensville, Mo.; Hamburg, Mo. and Woodriver, Ill. The station at Glenn Pool belongs to the Oklahoma Pipe Line Co., and the station at Woodriver, to the Illinois Pipe Line Co. The other stations are owned by the Ajax Pipe Line Co.

Pipe line on skids ready for lowering into ditch.

The pump station at Pryor has three 30,000-bbl. working tanks, and the station at Springfield has two 30,000-bbl. working tanks. The remaining stations have only one of these tanks.

At each of the pump stations there are three engines of the Diesel type and three pumps of the reciprocating type. The pumps east of Springfield are from one manufacturer and the pumps west of Springfield are from another manufacturer. The engines are similarly from two different companies. These are 500 horsepower engines and the capacity of each pump is rated at 32,500 bbls. daily. Two of these units operate at each station, while the remaining unit is a standby.

The flow chart shown in Figure 1 will indicate the revisions necessary to convert the entire system into a smoothly working medium for transporting a different kind of crude oil in each member of the twin arrangement without danger of mutual contamination. Obviously all of the stations must have a similar setup, a proposition which it is evident the Ajax company has considered in view of the flexibility already attained in the stations of which two serve as models for pumping units of a multiconsignment pipe line system. This flow chart shows an arrangement by which it is possible to run the crude oil from each line into separate working tanks, or indiscriminately, into common tanks.

Separation of Oils

At present the Ajax company is transporting mixed Mid-Continent crude oils through both lines and the arrangement in connection with the working tanks does not require a differentiation in the liquids to be worked against by the oil consignments as they issue from the reciprocating pumps into the manifold at greatly increased pressure. Aside from the advantages of large capacity and security against shutdowns because of breakage in a line, there are potential features which are of even greater interest.

With all of the stations equipped as the pumping unit at Springfield, most of the difficulties in transporting different kinds of crude oil or its products over the same system without mutual contamination vanish without the sacrifice of compact organization which permits the greatest economy in this type of operation. Nor is the flexibility of the system affected when the additional advantage is realized.

The matter of taking care of the surge effect in the lines is of special interest in connection with a fourth possible assignment for the twin pipe line, this is, the transportation of gasoline along with a shipment of crude oil. Regardless of

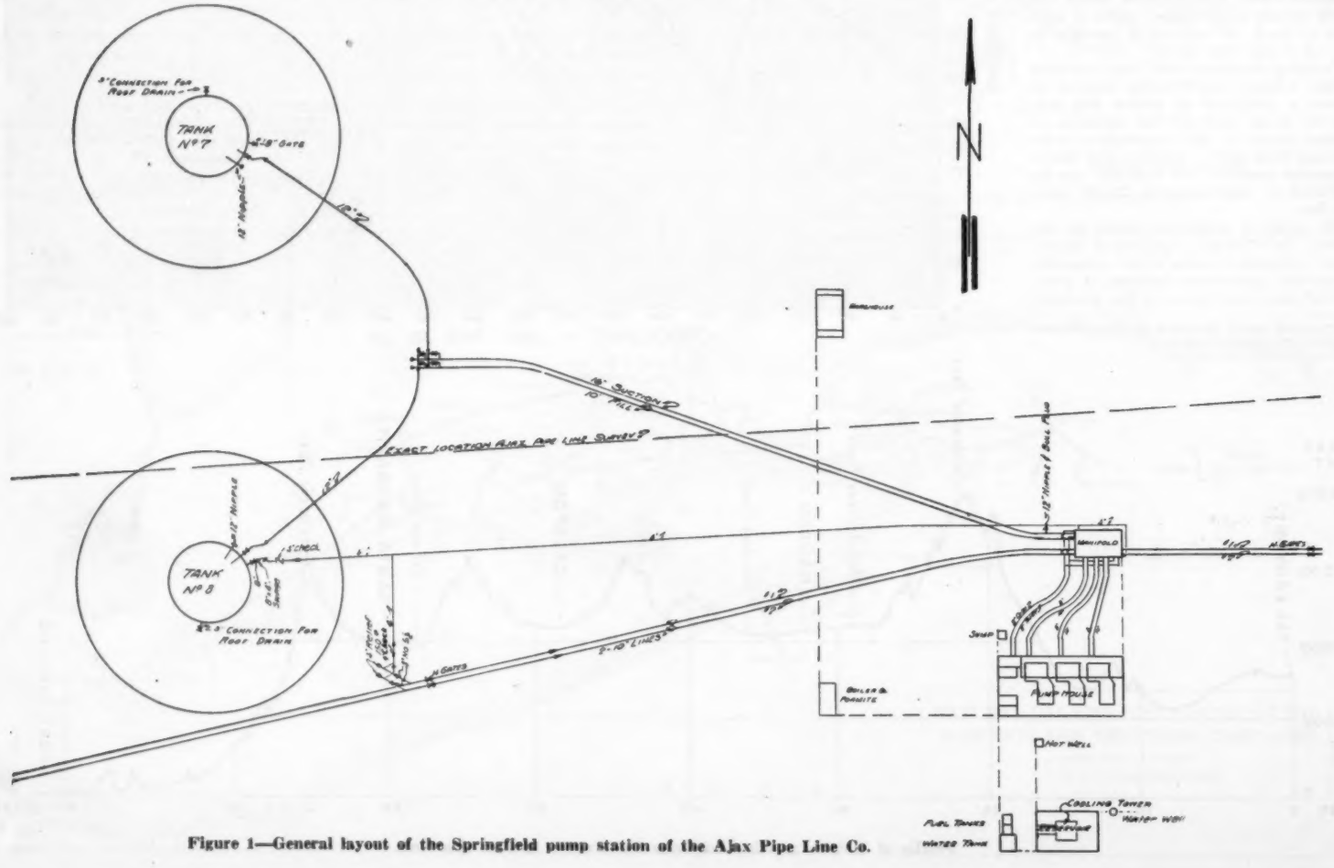
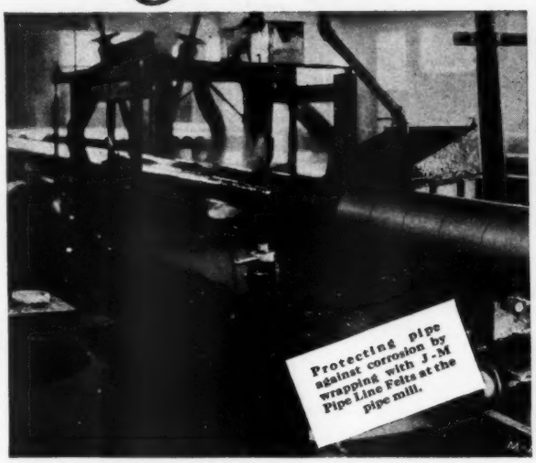


Figure 1—General layout of the Springfield pump station of the Ajax Pipe Line Co.

HERE IS *security* *against* PIPE-LINE *corrosion*



J-M ASBESTOS PIPE LINE FELTS

can be applied by hand or by machine at the mill, in the yard, or in the field

AT a fraction of the cost of reconditioning, this permanent protection is security against moisture penetration... soil stress... and electro-chemical action.

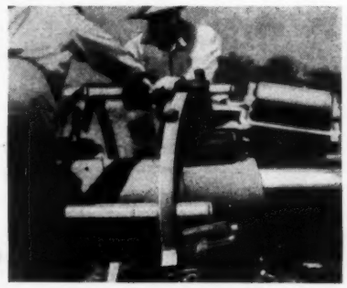
Asbestos Felts, because of their strength, immunity to rot and decay, and resistance to electrical and chemical action, have for many years provided the ideal reinforcement in all types of waterproofing construction.

Owners of more than 10,000 miles of pipe lines have purchased security against corrosion by incorporating J-M Asbestos Felt Wrapper in their pipe protection. The Asbestos Felt Wrapper adds to the waterproofing provided by the bitumen coating and successfully combats electrolytic and galvanic actions. It distributes the clod pressure and takes the shear and pull of soil action.

From the standpoint of better application and lower costs, we recommend wrapping by machine whenever possible. Mechanical wrapping applies the Asbestos Felts tightly and smoothly... with a uniform generous overlap.

Johns-Manville corps of engineers is especially qualified to discuss pipe-line protection. Get in touch with your local office or address Johns-Manville, 292 Madison Ave., New York City.

Our new booklet, "Safeguarding Your Pipe Line Investment," will be sent on request.



Wrapping over hot coating on a 16-inch welded line with rotary-type field machine.

Johns-Manville Pipe Line Felts

the number of tanks at the station, that is, working tanks, it is not considered advisable to cut in with a number of bulk plants, so it is not to be expected that this company will ever plan to deliver gasoline or crude oil to marketing outlets at all of its pumping points.

Beside the principal hookup to the working tanks, check and relief arrangements are now operating at all of the stations. On each of the lines going into the manifold, as shown in Figure 1, there are check valves before the two gates. These lines connect with a 4-inch line which leads from the manifold to a working tank.

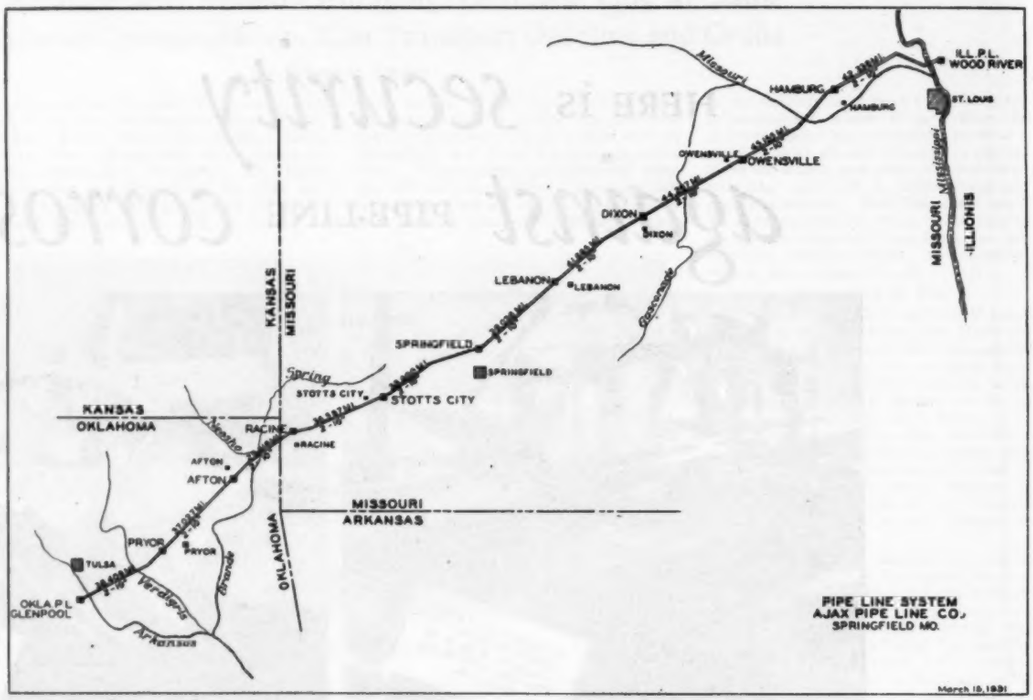
Arrangements for Gasoline

All of the tanks have special floating roofs which keep evaporation losses to a minimum in spite of the surging that may be expected in the fluid transported. The efficiency of this arrangement is indicated by the fact that only slight changes are seen as necessary in order to allow gasoline or a similarly volatile product to be transported in either or both of the lines.

In Figure 2 we obtain a closeup view of the pumping system at the Springfield station. The system for cooling water to the engines is indicated as a cycling arrangement, and a complete layout of fire lines, hydrants and Foamite piping is shown. The diagram also includes such details as sump pumps for the manifold and the engines, water pumps, fuel oil storage tanks and the like.

Here we are concerned only with the pump station and the consignment in the manifold lines at the pumps and at the manifold feeding the working tank. There are three sets of lines from the pump manifold to the manifold unit at the left. Each set has a 10-inch suction line and an 8-inch discharge line.

Oils in the two lines enter the manifold at the left (as indicated in Figure 1) and then go to the pump manifold to be returned to the first manifold and out to the next pumping station with greatly increased head. The fluid from the reciprocating pumps works against the surge tank arrangement indicated in Figure 1. At this station, where there are two working tanks, the 16-inch suction line and the 10-inch filling line from the manifold terminate in a system of valves where the streams are directed to and from the tank desired, or both tanks, as the case may be. Where separate consignments were to be handled without mixing no connection, as now exists, would be permitted between the tanks and an additional set of suction and filling lines would be in operation.



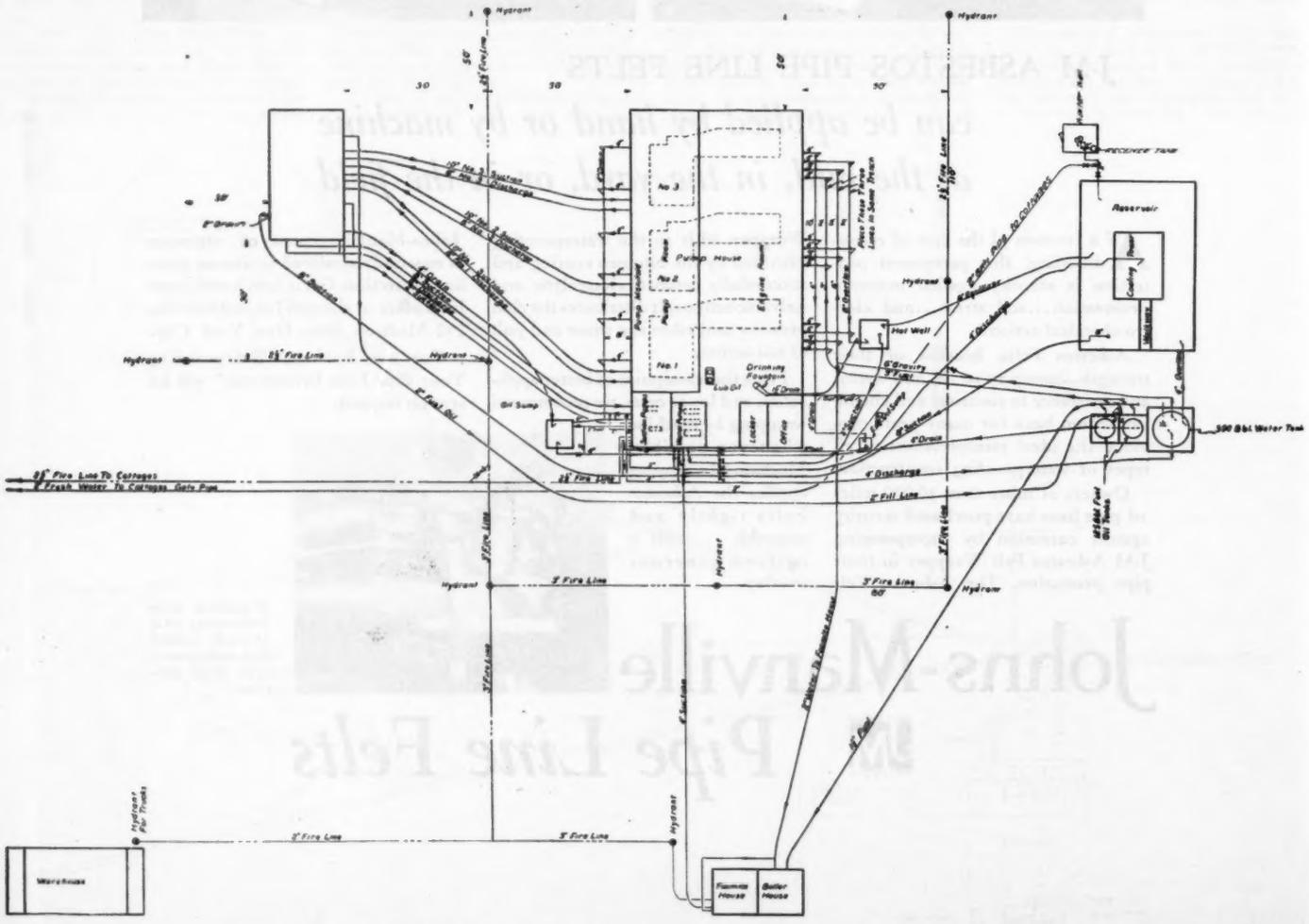
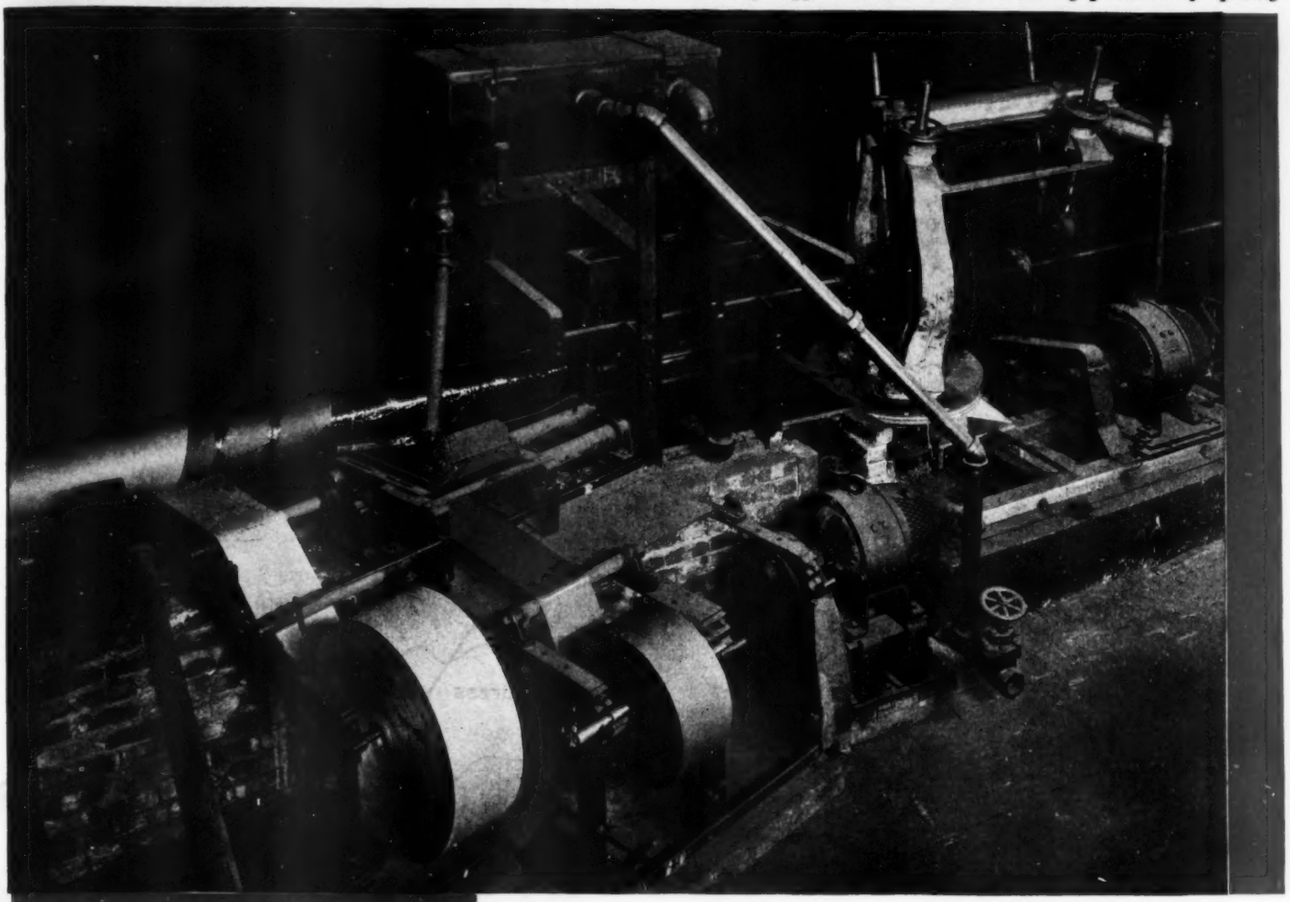


Figure 2—Piping arrangement at the Springfield pump station of the Ajax Pipe Line system.

The Coating and Wrapping is a continuous mechanical process. Felt and kraft applied under tension assuring precision of spacing



PROTECT

YOUR PIPE INVESTMENT AT THE TIME YOU ORDER YOUR PIPE

LINE PIPE is steel, and as such, is subject to corrosion — unless protected with a coating that is resistant to moisture, acids and alkalis.

Hand-coating of new pipe in the field offers but partial protection, and very expensive protection, to say nothing of the excessive cost of digging up old pipe lines, reconditioning and relaying them.

Stockholders in pipe line companies are looking for substantial dividends. They have every right to be disquieted if reports show great chunks gouged out of the profit column to pay for frequent reconditioning of the pipe lines.

The time to protect the pipe is *before* the pipe is laid. Pipe purchased at the mills listed below, mechanically coated and wrapped *at the mill* by the Hill, Hubbell & Company Process, does away with all uncertainty, lowers the cost of pipe protection and brings the pipe to the field thoroughly armored against corrosion, ready for weld and backfill. The outer wrappings, applied under high tension, protect the enamel coating during transit and after the pipe is in the ground act as a mechanical protection against soil-stress. Pipe protected by the Hill, Hubbell & Company Process of mechanical coating and wrapping gives years and years of uninterrupted and leak-proof service.

BITURINE COATINGS

Biturine Enamel — Biturine Solution No. 5
Biturine Enamel Primer — Biturine 70-30
Biturine Coupling Mixture

Biturine Enamel and Primer are perfectly adapted to the Hill, Hubbell & Company Process of mechanically applying coating to the pipe at the mill.

The Hill, Hubbell & Company Machine Coating and Wrapping Process was developed by the same group that has specialized for 23 years in protective coatings. Their plants are located in the following cities, for the production of the pipe manufacturers listed.

Central Tube Company	Ambridge, Pa.
Spang-Chalfant & Company	Ambridge, Pa.
Youngstown Sheet & Tube Company	Indiana Harbor, Ind., and Youngstown, Ohio
Jones & Laughlin Steel Corporation	Aliquippa, Pa.
National Tube Company	Lorain, Ohio
A. O. Smith Corporation	Milwaukee, Wis.

Pipe up to 26-inch diameter are coated and wrapped by the Hill, Hubbell & Company Process and conform to any specifications as to the number of machine-applied hot coatings and wrappings required.

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Spokane—711 First Ave.

Export Department: *Head Office*—
160 Fremont St., San Francisco, Calif., U.S.A.
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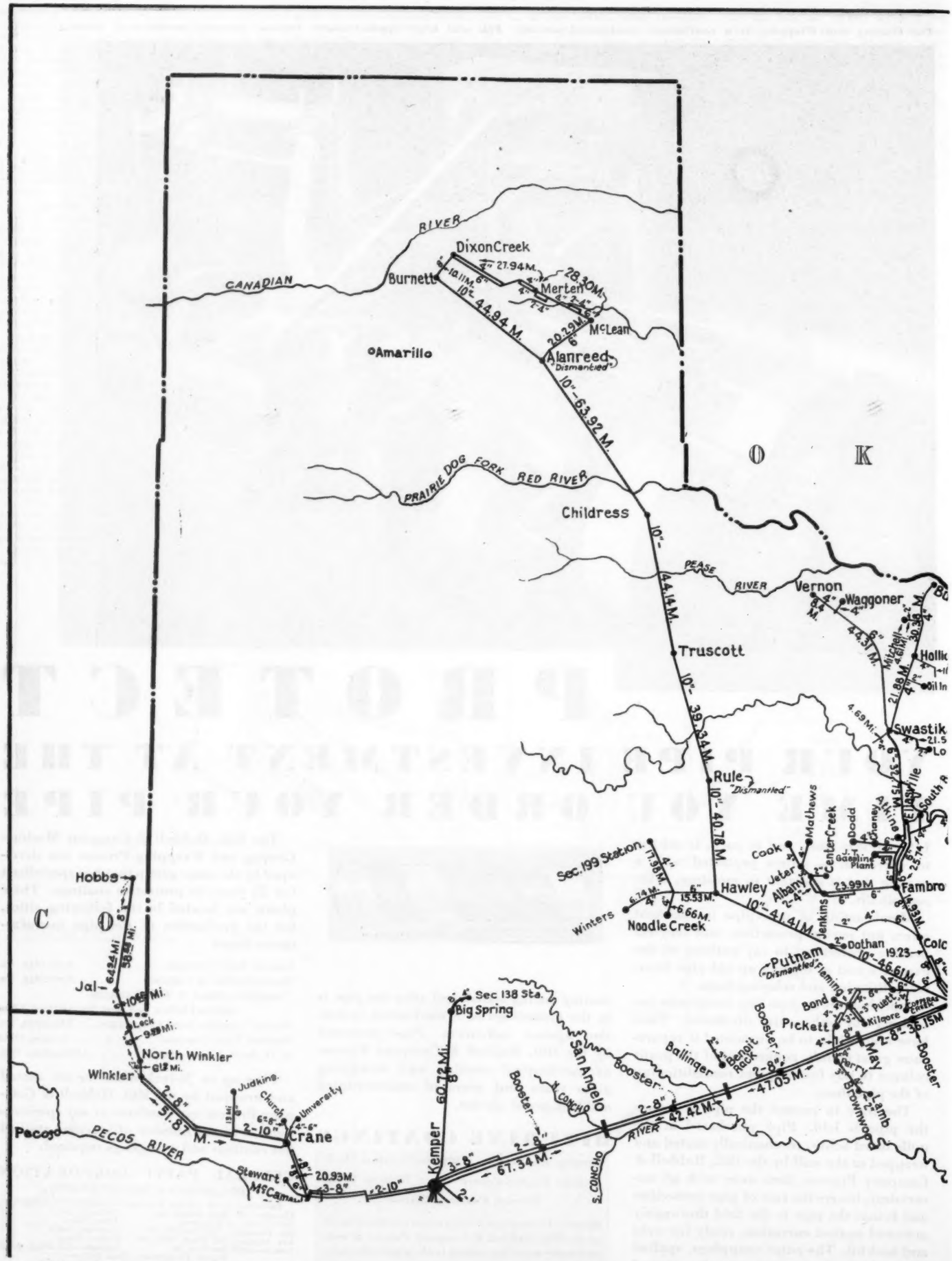
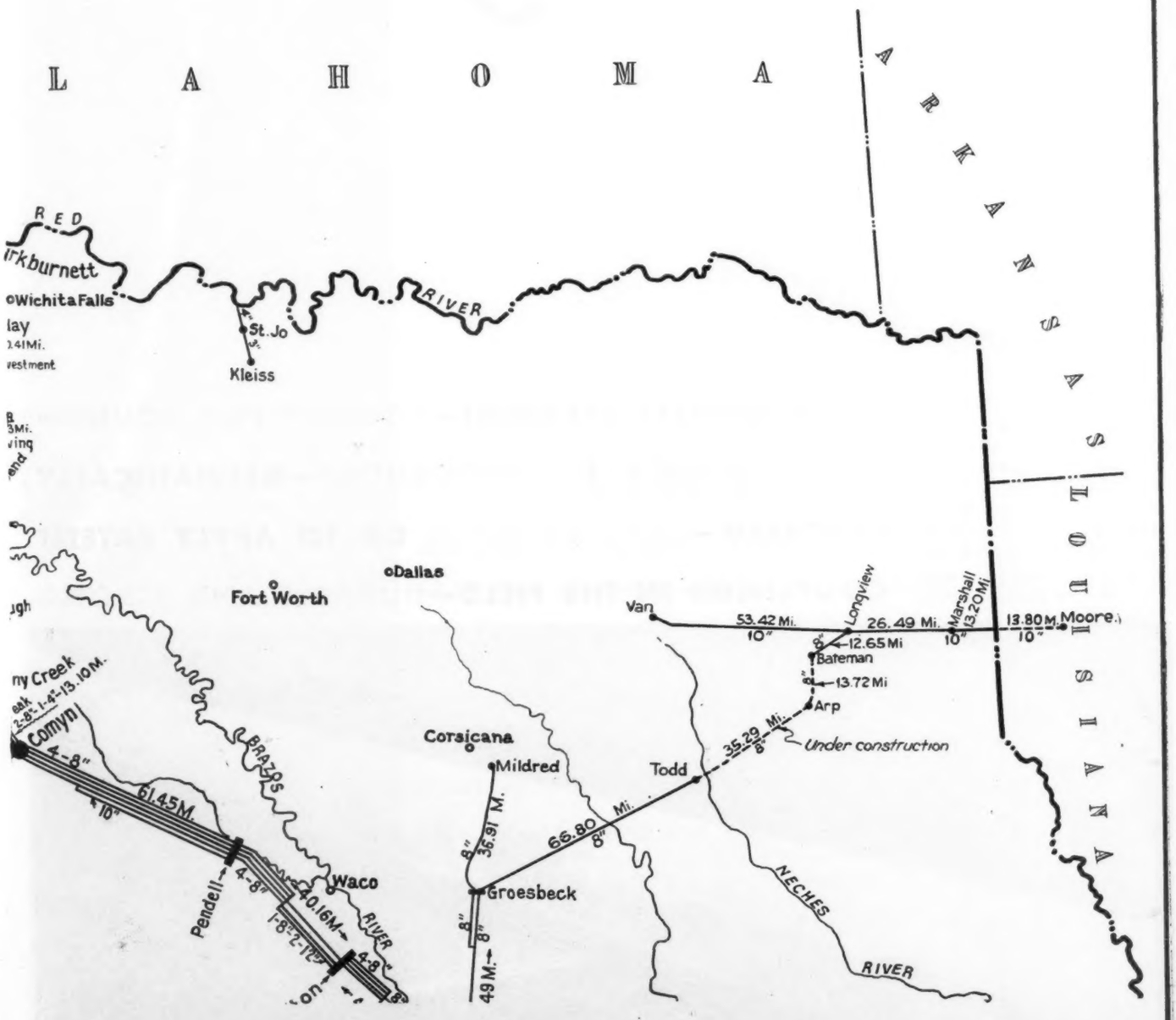

CANADIAN RIVER
Dixon Creek
Burnett
Merten
McLean
Amarillo
Alanreed
Dismantled
PRAIRIE DOG FORK RED RIVER
Childress
PEASE RIVER
Vernon
Waggoner
Truscott
Rule
Dismantled
Swastika
Sec. 199 Station
Winters
Noodle Creek
Hawley
Albany
Fambro
Cook
Mathews
Center Creek
Dodd
Haney
Jenkins
Dothan
Putnam
Dismantled
Flaming
Bond
Pickett
Booster
Ballinger
Benoit Rack
May
Brownwood
Lamb
Hobbs
Jal
Lock
North Winkler
Winkler
Judkins
Church
University
Crane
Pecos
PECOS RIVER
Stewart
McCamey
Sec 138 Sta.
Big Spring
Kemper
San Angelo
N. CONCHO
S. CONCHO
RIVER
Booster
2-8"
51.87 M.
67.34 M.
42.42 M.
47.05 M.
44.94 M.
63.92 M.
39.34 M.
40.78 M.
41.41 M.
46.61 M.
36.15 M.
60.72 Mi.
20.93 M.
28.30 M.
27.94 M.
23.99 M.
19.23
15.53 M.
6.66 M.
11.98 M.
6.74 M.
44.14 M.
44.31 M.
30.36 M.
21.88 M.
25.74
14.93 M.
20.29 M.
10.11 M.
4.69 Mi.

HUMBLE PIPE LINE COMPANY
MAP OF
PIPE LINE SYSTEM
NOT MADE TO SCALE
HOUSTON, TEXAS.



THE LOWER HALF OF THIS MAP WILL BE FOUND ON PAGES T-38 AND T-39

Youngstown

A line of 20" Youngstown Electric Weld pipe during its construction. Stretching mile after mile over hills, across valleys and rivers, this line has proved the unsurpassed physical characteristics and the remarkable ease of field handling of Youngstown Electric Weld line pipe.

EXCEPTIONALLY STRAIGHT—CONSISTENTLY ROUND—UNIFORM DIAMETER THROUGHOUT—MECHANICALLY DESCALED—EASY TO WELD OR TO APPLY PATENT COUPLINGS IN THE FIELD—DURABLE AND STRONG

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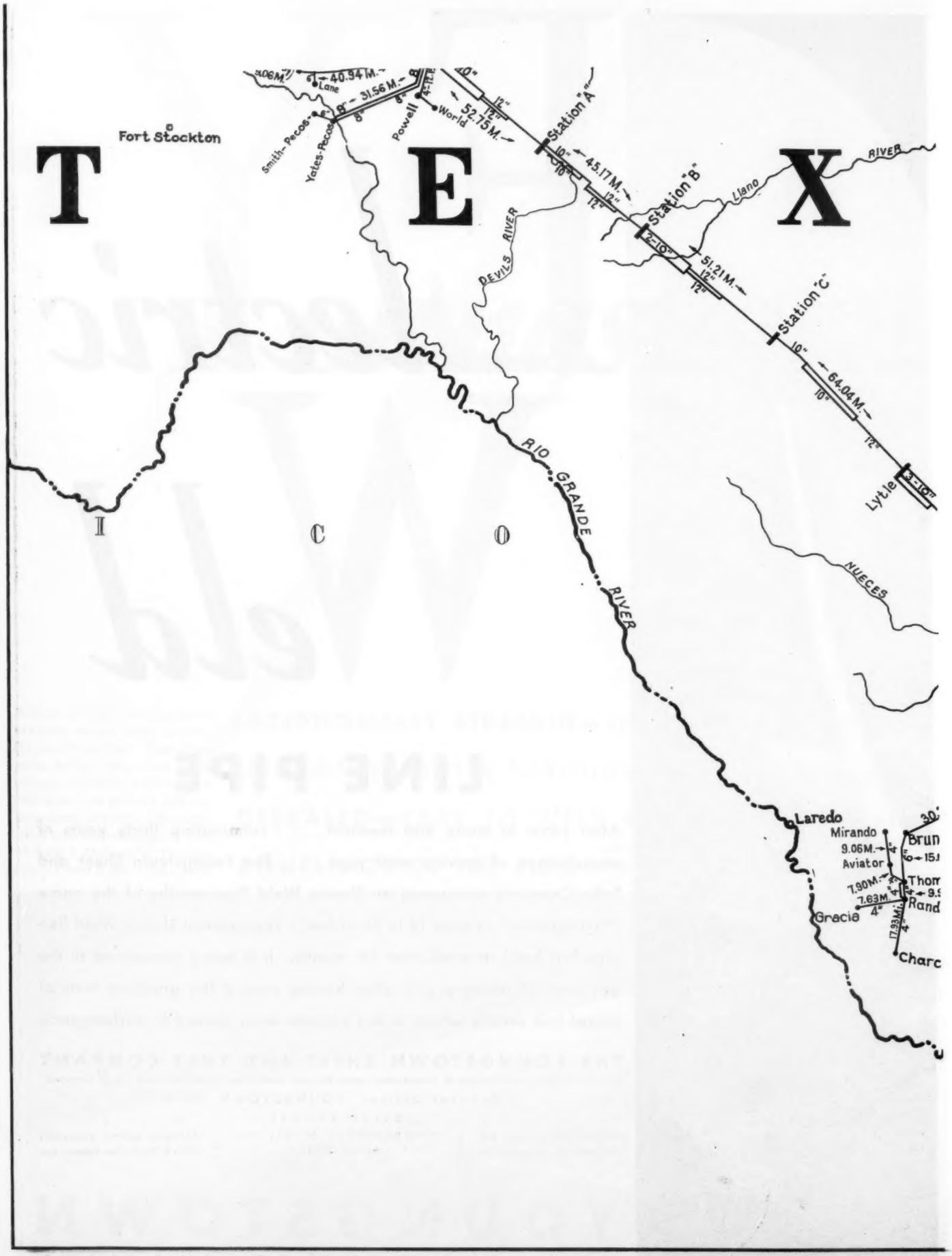
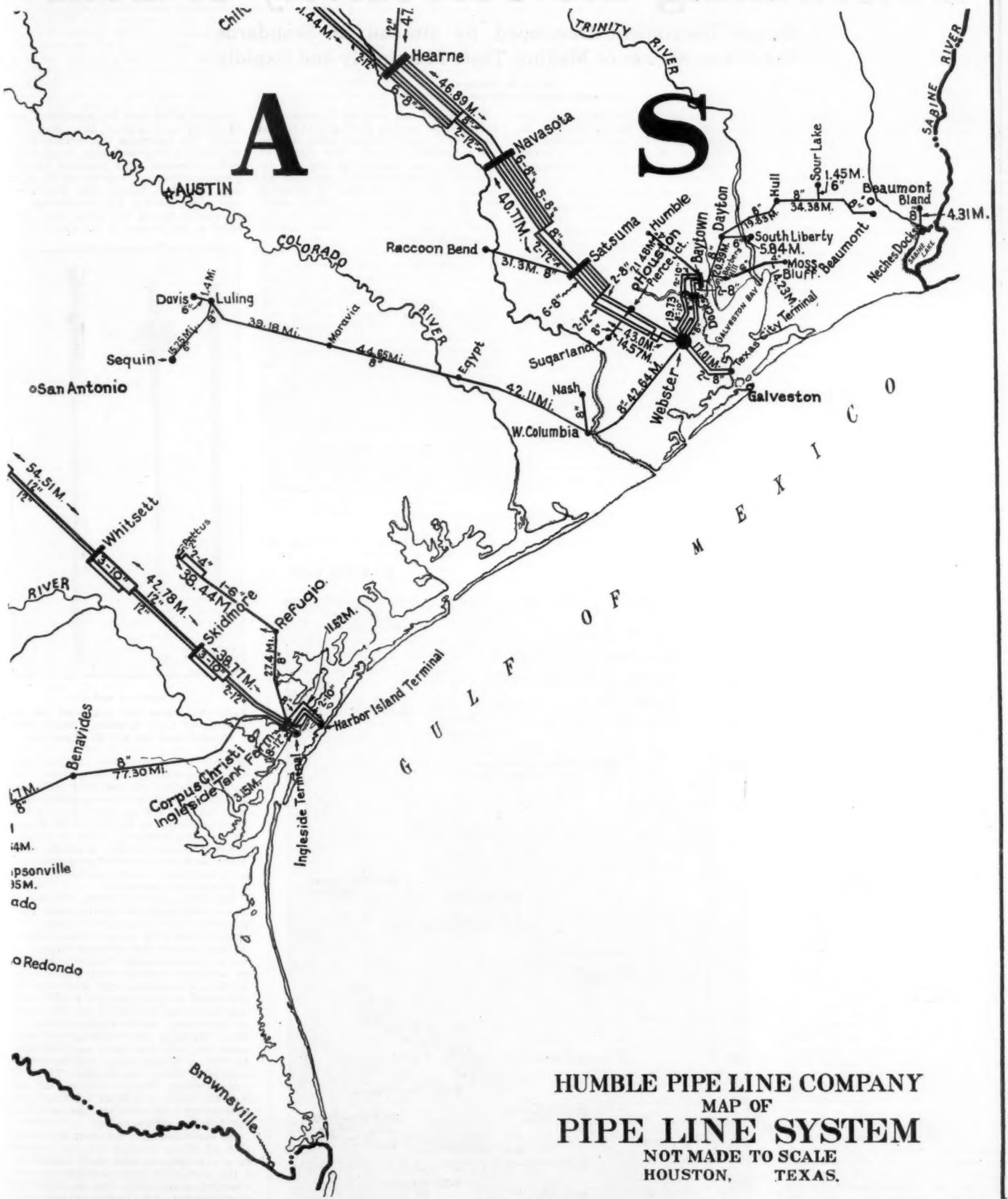
YOUNGSTOWN

FROM ORE MINE TO GAS LINE


T E X
Fort Stockton
Lane
40.94 M.
31.56 M.
Smith-Pecos
Yates-Pecos
Powell
World
52.75 M.
Station "A"
45.17 M.
Station "B"
Llano
RIVER
DEVILS RIVER
51.21 M.
Station "C"
64.04 M.
Lytle
RIO GRANDE RIVER
NUECES
Laredo
Mirando
9.06 M.
Aviator
7.90 M.
7.63 M.
Gracia
Brun
Rand
Charc



HUMBLE PIPE LINE COMPANY

MAP OF

PIPE LINE SYSTEM

NOT MADE TO SCALE

HOUSTON, TEXAS.

THE UPPER HALF OF THIS MAP WILL BE FOUND ON PAGES T-34 AND T-35

Determining the Corrosivity of Soils

Simple Instrument Developed by Bureau of Standards Facilitates Matter of Making Tests Frequently and Rapidly

By E. R. Shepard
Electrical Engineer, Bureau of Standards*

As data continue to accumulate from the Bureau of Standards corrosion tests as well as from other sources, the nature and extent of soil corrosion is gradually becoming better understood. That soil corrosion is a destructive agent of major influence has long been recognized, but the causes for it and its predetermination have been baffling problems up to the present time. The bureau's tests on buried pipe specimens in 47 soils have been helpful in showing the prevalence of soil corrosion and have shown that the character of corrosion of ferrous materials is determined more largely by the soil than by the kind of material affected. Other facts also are being brought to light which can be evaluated more accurately as time goes on.

That corrosion of a serious or destructive character on iron and steel is the rule rather than the exception is evident from an analysis of the data now available over an eight-year period as well as from an examination of the test specimens themselves. In not more than 6 of the 47 locations can the corrosion be said to be unimportant. In the other locations it ranges from mild to severe, the latter term being applicable to a considerable number of soils. Although in general the alkaline soils of the West and certain southern soils appear to be the most destructive to pipes, there are no geographical limits to the areas in which acute corrosion may occur.

The "Hot Spot" Problem

The experience of nearly every pipe line company and utility operator, which is also supported by the bureau's data, indicates that a large proportion of the destructive corrosion occurring on their systems is confined to relatively small areas. The problem of locating or predetermining such areas, particularly the so-called "hot spots" or excessively corrosive soils, is of great importance to the pipe owners, both in connection with the protection of new lines and the reconditioning or repair of old ones.

No satisfactory method of predetermining the corrosivity of soils has yet been discovered, although several methods which are more or less applicable to certain types of soils have been proposed and used. Chemical analyses have generally proven disappointing although in some instances such tests are indicative of corrosive properties. As corrosion is fundamentally an electrochemical process, it would seem that an approach from the electrical standpoint would offer the best line of attack. Corrosion of iron in the soil, so far as known, is accompanied by a flow of electric current, and a definite relation is known to exist between the amount of corrosion and the ampere hours involved in the process. Two factors and two only determine the magnitude of an electrical current, namely potential difference and resistance; the current in any circuit being directly proportional to the first and inversely proportional to the latter. As the earth surrounding a pipe constitutes the major portion of the electric circuits involved in corrosion it appears that soil resistivity should be one of the two controlling factors, or that, other factors being equal, the rate of corrosion should be proportional to soil conductivity. In practice, however, the influences of polarization at the pipe surface, the accumulation of corrosion products near the pipe, and other effects are so marked that soil resistivity, per se, has less relation to the problem than primary considerations would indicate. Several tests which have recently been proposed for determining soil corrosivity involve resistivity as the chief factor although they are designed to take into account, in one way or another, the modifying influences just mentioned. A brief description of these will be given. The first two described were developed in California.

Several Tests Described

In the Putnam[1] test a soil sample is subjected to a constant D.C. potential difference of 1.4 volts and the current flow measured after about 10 minutes, or when it becomes stable. The result, therefore, is a measure of the apparent resistivity of the soil after polarization has set in.

The Williams-Corfield[2] test involves measuring the loss of weight from a small sample of pipe after it has been connected as anode for 24 hours in a can containing a saturated sample of the soil in question. A constant potential difference of six volts is applied between the sample and the containing can. This test really amounts to measuring the average resistivity of the soil over a period of 24 hours, during which time the initial current is reduced, not only by polarization, but also by an actual change in the resistivity of the soil brought about by infiltration of corrosion products and by drying out.

The Legg[3] test consists in measuring the galvanic current flowing between an iron and a copper electrode when the two are embedded in the soil. The current so measured is a function of the soil resistivity but also involves a galvanic potential which is different in different soils, as well as polarization effects which are relatively larger than those encountered in the other tests where higher voltages are employed.

It is claimed for all of these tests that fair correlations are obtained between the measurements and observed corrosion, although it is admitted that actual field data of a reliable character on corrosion are meager. In comparing methods for determining corrosivity it is necessary to have some basis for comparison, and it is here that the greatest difficulty is encountered. Each investigator applies his test to a particular group of soils in which he is interested and on which he has some corrosion data, but until all tests are applied to the same soils, it is difficult to determine their relative merits.

Bureau of Standards Tests

Perhaps the most comprehensive and reliable data available on the corrosivity of soils are those obtained from the Bureau of Standards corrosion tests which have been in progress for more than eight years on which data for eight-year losses of weight and pitting have been compiled. To determine the relation of resistivity of saturated soils to corrosion and to compare other proposed tests for predetermining soil corrosivity, 22 of the soils, on which bureau data were available, were selected for examination. A corrosivity rating was given these soils, based on the product of the loss of weight of iron per square foot per year and the pit penetration in thousandths of an inch per year. An arbitrary scale was set up in which the most corrosive soils were taken as 100 per cent corrosive and other soils rated as 85, 70, 55, 40, 25 and 10 per cent corrosive. This is a more precise classification that is usually made where soils are rated as good and bad, or noncorrosive, mildly corrosive, corrosive, and very corrosive.

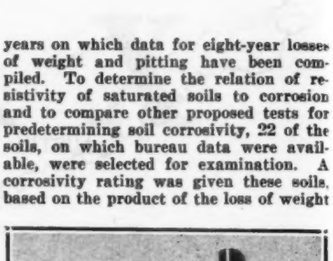
The accompanying chart, Figure 1, shows the results of plotting soil conductivity (the reciprocal of resistivity) against corrosivity rating as just defined. At first glance the shot-gun diagram is not very encouraging. However, a study of the chart, together with a knowledge of the soil properties, will show that the acid soils or those having a pH value less than seven fall toward the lower part of the sheet, while alkaline soils, or those having a pH value greater than seven lie in a zone above the acid soils. In fact a straight line can be drawn separating these two groups. There is one exception, that of tidal marsh, soil No. 43, which is a freak soil and nonconforming from every standpoint. This soil falls far off the chart.

An examination of the chart will show that all of the alkaline soils are ranged in a relatively narrow band, indicating a fair correlation between corrosivity and electrical conductivity. For the acid soils there appears to be no satisfactory relation whatsoever. A further examination of the chart will show that most of the acid soils are southern soils while most of the alkaline soils are to be found in the West.

The Putnam test, the Corfield test,

[1]Predetermination of Soil Corrosion, Joseph F. Putnam, The Oil and Gas Journal, November 13, 1930, page 158.
[2]Running a Soil Survey, Guy Corfield. Western Gas, March, 1930.
[3]Early Steps in the Development of the Columbia Soil Rod, Buell B. Legg, Gas Age Record, January 24, 1931.

Figure 1



Figures 2 and 3.

Left—Apparatus for measuring the resistivity of earth in place. Right—Two electrode rod for use in auger hole.

*Publication approved by the director of the Bureau of Standards of the United States Department of Commerce.

and the Legg test were all run on the same 22 soils shown in the chart. In general they gave about the same pattern as obtained by plotting corrosivity against conductivity, although in each test a few soils showed considerable departure from this pattern. All three tests rated soil No. 13 from Bakersfield, Calif., much too low in corrosivity. This is a highly corrosive soil, rich in soluble carbonates. The high polarization which develops in this soil when current is passed between iron electrodes accounts for the low corrosivity rating given it by the three tests. Soil No. 28 which also shows marked polarization is rated too low by all four tests; the departure being most pronounced in the Corfield and the Legg tests.

While little can be said for the superiority of any one of these methods as compared with the others, the results of the study indicate that the measurement of soil resistivity is the simplest and most satisfactory test available to determine the corrosivity of soil and that such a test may be used as a rough index of the corrosivity of alkaline soils. No electrical test yet devised appears to offer a generally satisfactory index for the corrosivity of acid soils.

This observed relation of resistivity to corrosivity in many soils is confirmed by a study which the Bureau of Standards carried out along a number of pipe lines in the southern states during the spring and summer of 1930. The primary purpose was to determine the relation of electric currents on pipe lines to corrosion, but measurements of soil resistivity also were made and these added greatly to the value of the investigation. A brief summary of this work was included in the report of K. H. Logan which he presented at the meeting of the American Petroleum Institute in Chicago in November, 1930, and reprinted in The Oil and Gas Journal of November 13, 1930. A full report will shortly appear in the Bureau of Standards Journal of Research.

Currents Found on All Lines

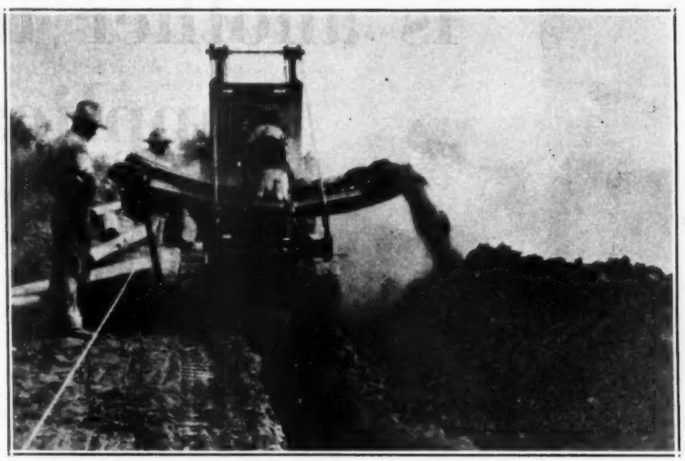
Measurable currents of galvanic origin were found on all pipe lines examined and marked variations in soil resistivity were discovered along most of the lines. In general the collecting areas, or those sections in which current flowed from the soil to the pipe, were regions of normal or high resistivity, while the discharge zones were usually relatively small in extent and were regions of low resistivity. On eighth of the nine lines explored, abrupt changes in soil resistivity from high to low values were accompanied by unusually high rates of discharge of current from the pipe to the earth, and in such areas excessive corrosion was usually found to be in progress. In short, hot spots or excessively corrosive areas of limited extent can be located by either a study of galvanic currents on the line or by the measurement of soil resistivity. While no direct quantitative relation was found to exist between corrosion and soil resistivity it is significant that soils having a resistivity of about 500 ohm-cm. or less were invariably found to be highly corrosive.

As much of the destructive corrosion on pipe lines occurs in these local, low-resistivity zones, their location is a matter of great importance and any precedure that will facilitate their predetermination will be of value to the operators. While the resistivity test has been shown to be significant at least in certain types of soils there is a great need for further correlations to determine the limits of its application. This can be done most effectively in the field where actual corrosion, as determined by pit depth measurements, should be compared with the resistivity of the adjacent soil. The bureau will welcome an opportunity to make such studies where pipes are exposed for reconditioning or for other reasons.

Simple Apparatus Developed

To expedite the measurement of soil resistivity a simple apparatus has been developed at the Bureau of Standards by which tests can be made easily and quickly in the field and the necessity of taking samples to the laboratory for examinations thereby avoided. This instrument, shown in Figure 2, consists of two metal tipped wooden rods, one of which carries a milliammeter and a small 3-volt flashlight battery. A wire between the two rods completed the circuit. These rods are pushed into the earth to the depth at which the resistivity is to be determined and a reading is obtained by closing a push button switch. The scale of the instrument is calibrated to read the resistivity of the earth directly in ohm-centimeters.

Trouble from polarization, which is usually encountered when direct current is employed in making measurements of the resistivity of electrolytes, is largely eliminated by using electrodes differing greatly in area and making the larger one the cathode. When current is made to flow between two metal electrodes submerged in soil or any similar electrolyte, polarization quickly takes place on the metal surfaces, which reduces the strength of the current below the initial value. It is because of this effect that alternating current is usually employed for making resistivity determinations of soils or other electrolytes. Under these conditions polarization is largely a cathodic effect, that is, it is most pronounced on the electrode through which the current leaves the electrolyte. It is also a function of the current density. Therefore by making the cathode very large in comparison with the anode the current density on the former is proportionally small and the polarization is greatly diminished. By employing this principle in the instrument just described it is possible, with direct current, to measure the resistivity of soils with an accuracy closely approaching that obtained with an A-C bridge. Electrodes having areas of about 0.3 and 3.6 square inches respectively are employed. Iron is found to be more satisfactory than brass or copper as it develops less polarization than either. A meter of low internal resistance, such as a milliammeter, is preferable to a voltmeter of high resistance. The calibration constant of such an instrument is approximately 3; that is, the soil resistivity of ohm-centimeters is equal numerically to three times the measured resistance between the electrodes when they are separated in the earth, by about 8 inches or more. The calibration constant is practically independent of the resistivity of the medium.



A trenching machine "doing its stuff."

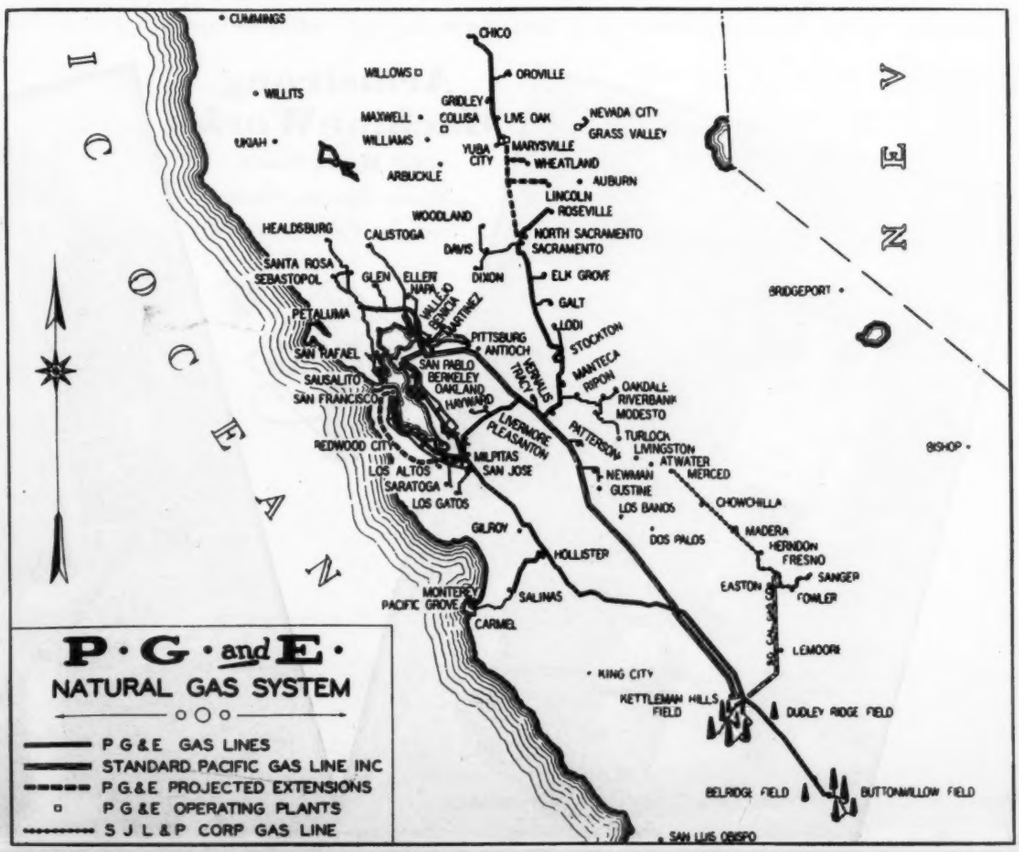
The rod shown in Figure 3 carries two electrodes and is designed for use in a 1½-inch auger hole where resistivity measurements at a considerable depth are desired. For deep work it has the advantage of requiring only one test hole, while the two-rod apparatus is more suitable for shallow or open trench work. The single rod has the same calibration constant as the other device and is used in conjunction with the anode rod shown in Figure 1, which carries the battery and meter. When the single rod is being used the small anode rod is employed merely as a support for the meter and battery.

Simplifies Making Tests

This apparatus will permit of making frequent and rapid tests of earth resistivity along a pipe line or along a projected pipe line. Although it is not claimed that absolute values of resistivity are obtained, the results will be sufficiently accurate for all practical purposes, provided the soil is not too dry. It is important, therefore, to test the earth at pipe level and where there is sufficient moisture to afford nearly maximum conductivity. Measurements should not be made in dry soil as they will mean nothing, even though a deflection on the meter is obtained. Damp soil which will pack in the hand will usually show a conductivity approaching that of a saturated condition. Access to the desired depth can be obtained by driving a steel bar to make a hole or by using a soil auger.

The intervals at which such tests should be made will depend upon the character of the soil and perhaps other factors. To be sure that no extensive hot spots are missed, it may be necessary in some locations, to make tests at intervals of 100 feet or less, while in other areas the vegetation and typography may be depended on to a large extent to indicate the character of the soil.

Until further correlations are obtained, covering a wide variety of soil conditions, resistivity values should be considered as indicative of corrosive areas only when the resistivity is unusually low or where abrupt changes are observed.



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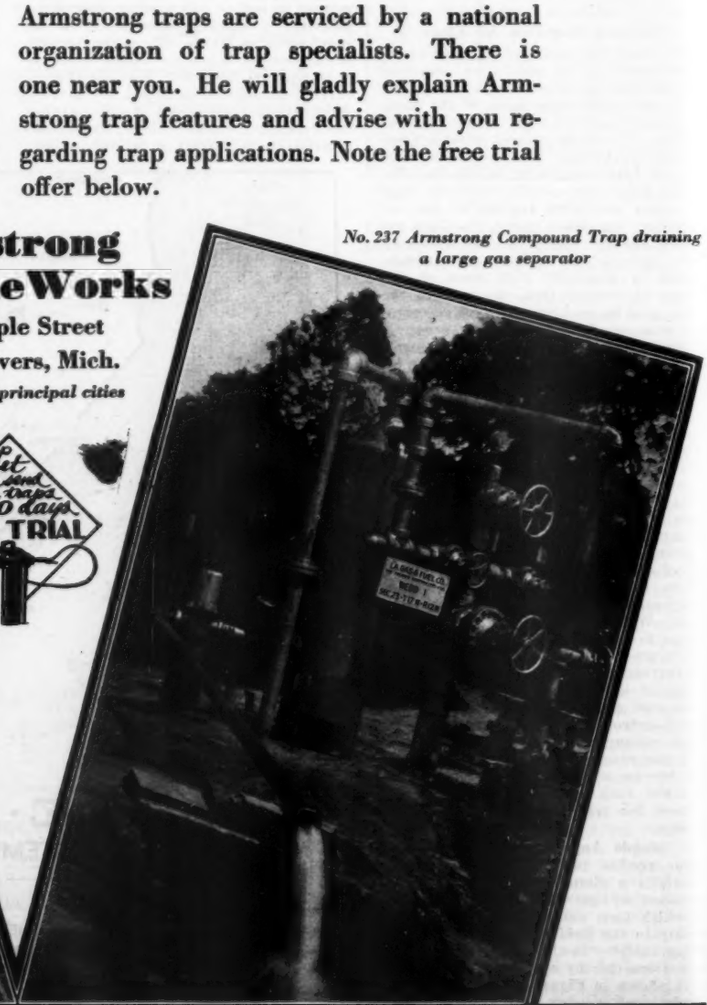


OGJ 6-4 Gray

What Should We Pay for Pipe Coating?

California Engineer Treats Subject in Different Manner and Cites Five Cases for Consideration

By H. B. Truett
Engineer, Associated Oil Co.

Oil and gas pipe lines frequently are subject to serious corrosion and the protection of the pipe is an important factor when planning new lines, or reconditioning old ones. It is not intended in this discussion to deal with how a pipe line should be protected, but to point out what is thought to be a logical method of arriving at what we should pay for pipe line protection. Millions of dollars are expended annually to combat the destructive corrosion of pipe lines. How are these expenditures justified? On what basis and by what method is an expenditure for pipe line protection determined? Pipe line protection is undoubtedly justified in many instances, but we should be reasonably sure of the economic soundness before we proceed with such expenditures.

There is a diversity of opinion, as there might well be, on how to calculate the maximum expenditure for pipe line protection that would be justified under a given condition. For example, if the useful life of a pipe line may be increased 30 per cent by means of a certain type of protection, some persons might suggest the maximum that would be justified for protection would be 30 per cent of the cost of the unprotected pipe line, but such is not the case as I will try to show further on.

Cost of Transportation

If we build a pipe line from an oil field to a refinery or to tidewater, we probably do so because it will furnish the cheapest means of overland transportation, and the difference between the cost of pipe line transportation and the next cheapest means is the profit that justifies the investment. The profit presumably continues throughout the useful life of the pipe line, although it may vary, and, other things being equal, the profit will be greatest for the least investment consistent with proper design and construction for the purpose. I state this because I wish to point out that the pipe, per se, of a pipe line system will not transport the commodity one whit better because of anything that may be applied to the outside of the pipe to protect it against corrosion, and, therefore, the extra investment for protection should earn a fair rate of interest for the useful life of the pipe line, and by some other means than the direct transportation of the commodity.

The cost of transporting oil by pipe line is the cost of operation, and a factor in the cost of operation is the cost of returning the amount of the investment when the pipe line has lived its useful life. The generally accepted method is so-called depreciation, whereby a certain sum is charged annually against operation and credited to replacement. In other words, if the useful life of a pipe line is 25 years, one-twenty-fifth of the original cost is charged annually against operation and credited to an account that will either replace the pipe line at the end of its useful life or return the original investment. Interest on such annual sums is generally neglected.

Return of Investment

The return of a sum equal to the original investment at the end of the useful life of a pipe line may be determined by several different methods, and the correctness of the method depends upon the viewpoint and often leads to considerable difference of opinion. What we are leading up to, however, is not so much the method per se of returning the original investment as to what we should pay for pipe line protection. However, in determining what we should pay for pipe line protection our method is influenced by the way in which we agree an original investment should be returned at the end of the useful life of the pipe.

It should be understood that the pipe line, as referred to herein, means the pipe, per se, buried in the ground without right of way or valves, tanks, pumps and other items that go to make up a complete pipe line system.

It should also be understood that in this discussion I assume the pipe line is owned and operated for the benefit of a private business, and not a common carrier.

For comparative purposes in discussing the various methods of determining the maximum, we should pay for pipe line protection, I have arbitrarily assumed certain factors as follows:

(a) The life of a base or unprotected pipe line is 15 years.

(b) The additional life of the pipe line due to protection is five years.

(c) The cost per mile for an unprotected pipe line is $7,920.

(d) The value of money is 6 per cent.

Examples Are Cited

Case 1 is based upon the assumption of straight depreciation. In other words, the annual expense is the total cost divided by the useful life of the pipe line in years. In this case $7,920 divided by 15 years equals $528, the annual depreciation for an unprotected pipe line. For the protected line on the same basis the maximum we could afford to pay for protection is $2,640 per mile as $2,640 plus $7,920 divided by 20 years equals $528 per annum. However, this system does not seem logical in the second part because a protected pipe line will not earn any more than an unprotected pipe line so far as transporting the commodity is concerned and, therefore, any additional investment for protection should be charged with a fair rate of interest.

Amortization

Case 2 is based upon amortization. In other words, annual payments to a fund that will equal the investment at the end of the useful life of the pipe line, interest earned by monies paid into the fund being compounded annually. In this case the unprotected pipe line would require annual payments of $340.24 with money at 6 per cent. For the protected pipe line, assuming the same annual charge, we could afford to pay a maximum sum of $4,598.14 because this sum plus $7,920 equals $12,518.14, a sum that will be amortized by annual payments of $340.24 over a period of 20 years, with money at 6 per cent.

Now, while the method may be perfectly businesslike so far as the first part is concerned, it is not in the second part because no provision is made for interest on the increased investment for protecting the pipe line, the reason for which was explained before, and the sum of $4,598.14 for protection is unreasonable.

The Matter of Interest

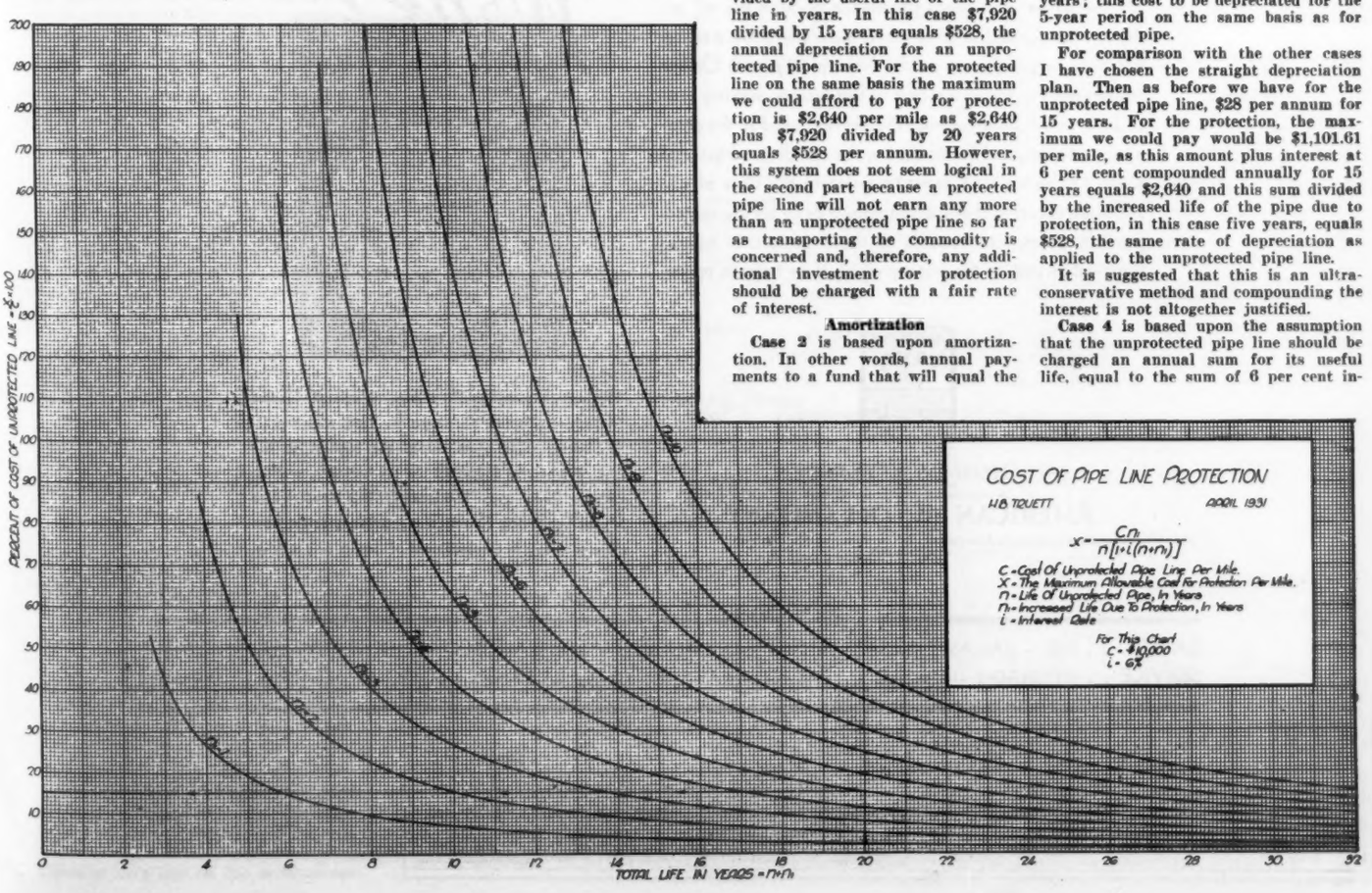
Case 3 is based upon the assumption that the cost of protection for a pipe line should be charged with interest compounded annually for the life of the unprotected pipe line, and the sum, i.e., the cost of protection plus compound interest, should then be depreciated for the period represented by the increased life of the pipe line.

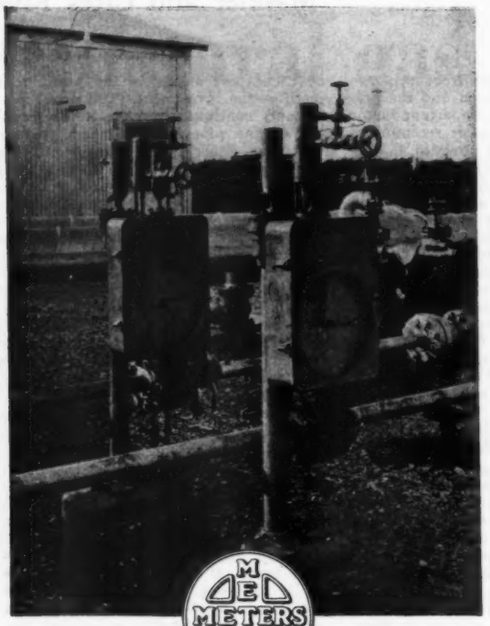
On this basis we have two parts to our problem. First, the 15-year life of the unprotected pipe line depreciated as straight depreciation or amortization as you choose. Second, the cost of the five-year life based upon the cost of protection with compound interest for 15 years; this cost to be depreciated for the 5-year period on the same basis as for unprotected pipe.

For comparison with the other cases I have chosen the straight depreciation plan. Then as before we have for the unprotected pipe line, $28 per annum for 15 years. For the protection, the maximum we could pay would be $1,101.61 per mile, as this amount plus interest at 6 per cent compounded annually for 15 years equals $2,640 and this sum divided by the increased life of the pipe due to protection, in this case five years, equals $528, the same rate of depreciation as applied to the unprotected pipe line.

It is suggested that this is an ultra-conservative method and compounding the interest is not altogether justified.

Case 4 is based upon the assumption that the unprotected pipe line should be charged an annual sum for its useful life, equal to the sum of 6 per cent in-





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terest on the cost, plus the cost divided by the useful life in years, and the greatest amount we should pay for pipe line protection would be a sum which, when added to 6 per cent of the same for the total life of the pipe line and divided by the increased life due to protection would equal the annual charge for the unprotected pipe line.

Then in this case the depreciation charge would be $7,920, the cost of the unprotected pipe line, divided by 15 years life, equals $528, plus 6 per cent on $7,920, or $475.20, giving an annual charge of $1,003.20. The greatest amount we should pay per mile for pipe line protection would be $2,280, because 6 per cent of $2,280 equal $136.80, and multiplied by 20 years equals $2,736, and $2,736 plus $2,280 equals $5,016, and divided by five years equals $1,003.20.

The method of figuring in this case seems rather odd, and the reason was not given to the writer. However, the final result is more out of line than Case 3 and the figure is too high.

Case 5—This is offered by the writer as a logical method for determining the maximum we should pay for pipe line protection. It is based upon the assumption that an unprotected pipe line should be depreciated in annual amounts equal to the cost of the pipe line divided by its useful life in years, and that the cost of pipe line protection should not exceed a sum, the value of which when added to 6 per cent simple interest on itself, multiplied by the total useful life of the pipe line in years, and to this sum is added the cost of the unprotected pipe. This total, in turn, divided by the total useful life of the pipe in years will equal the annual depreciation as figured for the unprotected pipe line.

The foregoing is based upon the contention that a protected pipe line will not earn any more than an unprotected pipe line, so far as the mere transportation of the commoditiy is concerned, and, therefore, any additional investment over the cost of an unprotected pipe line should be charged a fair rate of interest for the useful life of the pipe line.

Then, on the above basis we have for the unprotected pipe line, $7,920 divided by 15 years equals $528 annual depreciation. For the maximum sum we should pay for pipe line protection we have $1,200, because $7,920, the cost of the unprotected pipe, plus $1,200, the cost of protection, plus $1,440, the simple interest on $1,200 for 20 years at 6 per cent, equals $10,560, and this sum divided by 20 years equals $528.

Tabulating the five foregoing cases above, we have:

Case—	Cost of an unprotected pipe line per mile	Depreciation for an unprotected pipe line per annum	Maximum cost for pipe line protection
1.....	$7,920	$528.00	$2,640.00
2.....	$7,920	340.24	4,598.14
3.....	$7,920	528.00	1,101.61
4.....	$7,920	1,003.20	2,280.00
5.....	$7,920	528.00	1,200.00

Author Favors Case 5

As above stated, it is the writer's suggestion that Case 5 is the logical method for determining the maximum we should pay for pipe line protection, under given conditions of life and cost, which, of course, vary with each individual problem. In every problem our starting point must be the cost of the unprotected pipe line. However, we should, in every case, have assurance that the pipe line in question will be required for its full useful life, for, obviously, it would be an economic waste to protect a pipe line if the added years of life are not required.

The figures assumed above, while not taken from actual life and cost data of a pipe line, nevertheless approach a reasonable possibility, and it is interesting to note that under Case 5 an expenditure of over 15 per cent of the original cost is justified for pipe line protection.

Another interesting viewpoint is: On the above basis the cost of an unprotected pipe line as assumed is $1.50 per foot. Now suppose that of this sum $1 per foot represents the cost of the pipe and the balance represents transportation and other items chargeable to labor. This is not far out of the way for pipe lines that have been built in the past 10 years. Now 15 per cent of $1.50 is 22.5 cents and this is 22.5 per cent of the cost of the pipe material, a large enough differential to make pipe manufacturers take notice and wonder if they should make pipe that will have greater resistance to corrosion than the present material.

For convenience in figuring the maximum that should be paid for pipe line protection as outlined in Case 5, the problem is stated as follows:

Let:

C = The cost of the unprotected pipe line.

x = The maximum allowable cost for protection.

n = Life of unprotected pipe, in years.

n_1 = Increased life due to protection, in years.

i = Interest rate.

Then:

$$x = (n+n_1)\left(\frac{C}{n} - ix\right) - C$$

$$= \frac{Cn_1}{n[1+i(n+n_1)]}$$

and for Case 5 we have:

$$x = \frac{7{,}920\times 5}{15[1+.06(15+5)]} = \frac{39{,}600}{33}$$

$$= 1{,}200$$

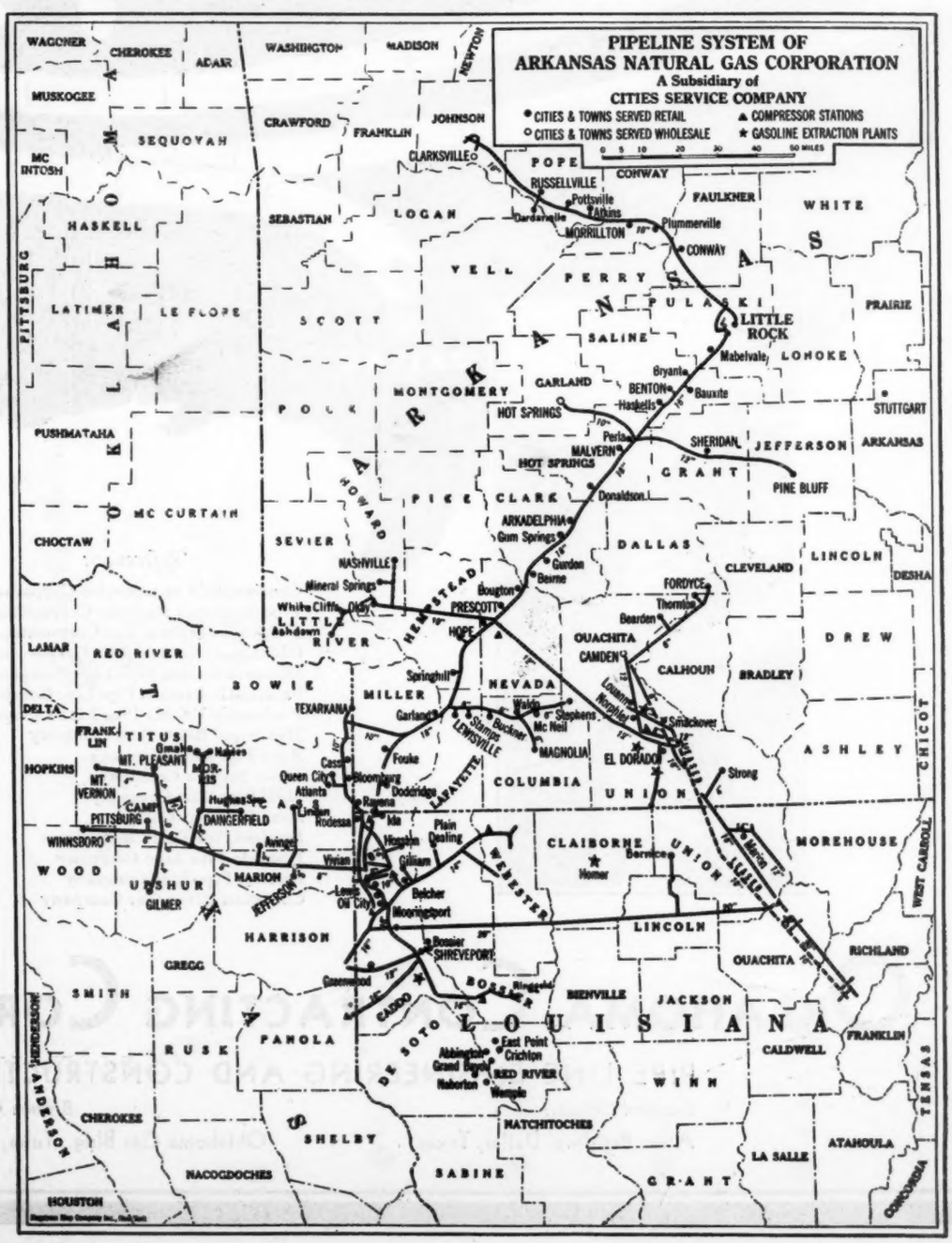
Curves Prepared

Based upon the above formula and with money at 6 per cent and a pipe line cost of $10,000 per mile, a set of curves have been prepared to solve for the value of x expressed in per cent of the cost of an unprotected pipe line. It is only necessary to assign proper values to the problem and obtain the answer from the chart as follows:

For example, take the problem of Case 5. First locate on the lower horizontal portion of the chart the total life of the pipe line in years, $n+n_1$, and in this case 20; follow up vertically to where the line intersects the curve representing the life due to protection, $n_1 = 5$; thence follow the horizontal line to left hand margin of the chart and read 15.2 per cent; 15.1515+ per cent to be more exact. 15.1515 per cent of 7,920 equals $1,199.9988, practically $1,200, which is the correct answer.

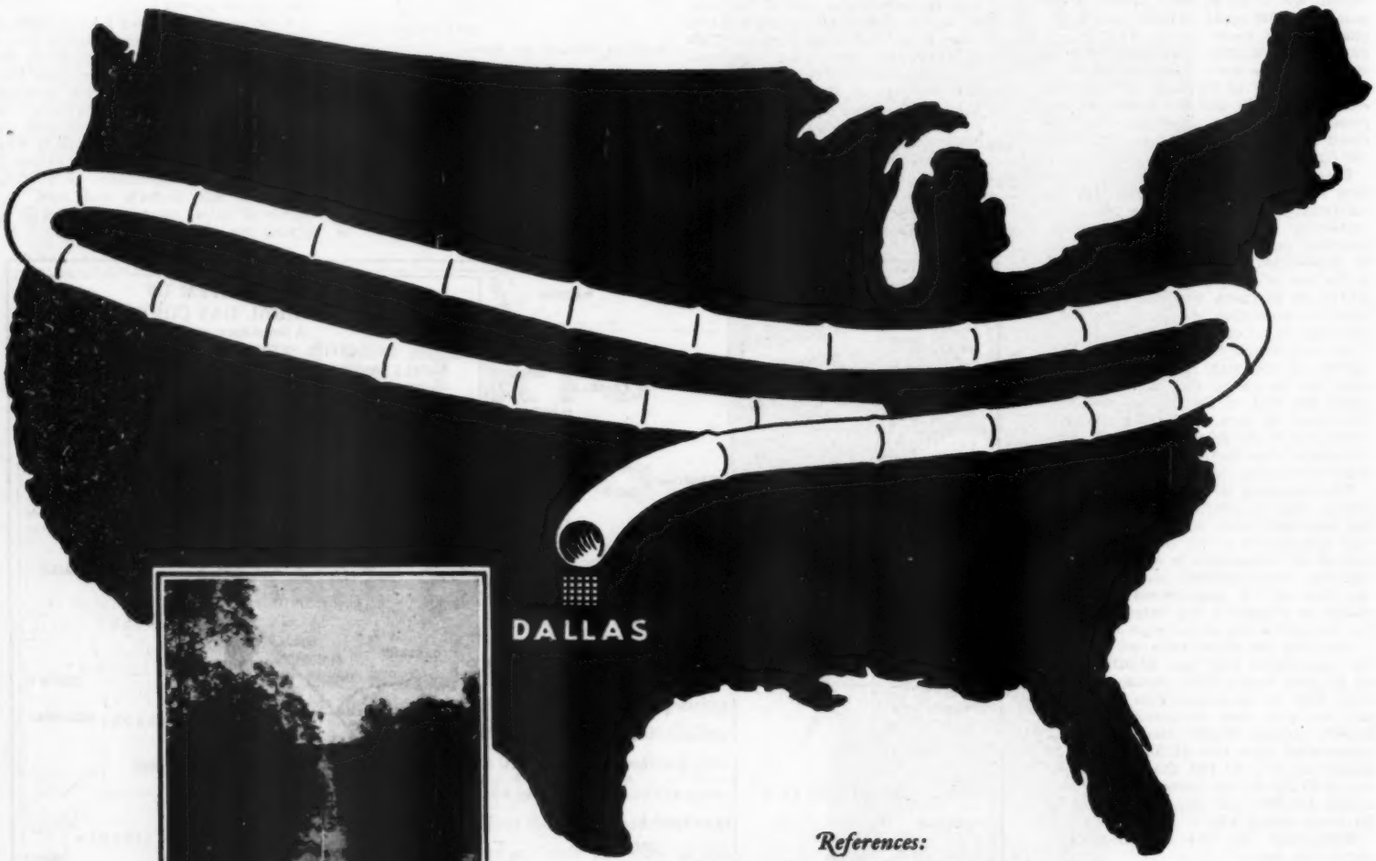
In all of the foregoing I have purposely neglected certain factors relating to protected pipe lines. However, it is well known from actual experience that lower operating costs obtain with protected pipe lines because of less failures, with a reduction of line losses and lost time due to tie-up for repairs. While it would be difficult to assign definite values for these factors, nevertheless they should be taken into account and used as a factor of safety or good measure in applying the rule under Case 5.

Ditching for a new oil line in Oklahoma.



PIPE LINES LAID BY OKLAHOMA

would reach more than twice across the continent



References:

Continental Construction Corporation
Producers and Refiners Corporation
Southern Natural Gas Corporation
Oklahoma Natural Gas Corporation
Missouri-Kansas Pipe Line Company
Panhandle Eastern Pipe Line Company
Panhandle Illinois Pipe Line Company
Mississippi River Fuel Company
Ajax Pipe Line Company
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Remote Control for Electric Stations

Interesting Features to System Which Is Attracting Attention Throughout Pipe Line Industry. One Station Equipped in Oklahoma

By L. G. E. Bignell
Petroleum Engineering Editor

With the increasing use of electricity as power for prime movers in all industries there has been an ever growing desire on the part of the designers and owners of power apparatus to reduce the manual operations to a minimum. The nature of the power used has lent itself to the accomplishment of rather unusual results in what is known as supervisory control systems, and types of such installations having been in operation since 1921 when the Cleveland (Ohio) Railways Co. adapted relays and circuit designs worked out for them by the Westinghouse Electric & Manufacturing Co.

With the introduction of electric motors into various operations in the petroleum industry from the simple well pumping outfits on through practically every branch of the industry to the marketing of the finished products to the ultimate consumer, there has been brought into the oil business a large number of electrical engineers.

These men having a personal knowledge of what has already been accomplished in other industries such as street railway systems, central power stations, automatic substations such as those used in railway and mining work, and automatic hydroelectric generating stations, desired to make application of this equipment to the control of pumping operations in pipe line stations.

The electrically driven pumps in pipe line stations have been gaining in favor during the past few years and additional advantages are anticipated by the application of supervisory control so that the switching on and off of pumping units and other operations usually performed by the operator in the station can be done from the office of the line dispatcher located at some distance from the pumping station.

It is hoped that in time details for such distant control will be so perfected that instead of a transportation system being considered a series of units of pipe line between pumping stations, the control will be located in the office of the dispatcher and he will be able to co-ordinate the several pump stations so that the whole system will be treated as one unit and all operating details controlled by one man.

Outline of System

Supervisory control is available which is entirely dependable, requires but two telephone lines for complete control of a multiplicity of operations and, in addition, gives a visible indication at the sending station of the operations which have been performed.

A control board can be used with this type of supervisory control which shows a layout of the controlled station or stations in diagrammatic form and pictures to the operator the exact condition existing in the controlled stations. Lights represent the valves and other controlled apparatus located in the pump station at some distant point.

Making use of such a system makes it possible to change operators at any time and the incoming operator to be immediately informed, upon looking over the control board, of the position of apparatus in all stations within the system.

Some of the features of this supervisory control system include the use of two line wires somewhat similar to a telephone line; the supervisory control equipment is normally at rest; any type of apparatus unit can be controlled and supervised; continuous, individual lamp supervision for each apparatus unit is arranged; selective remote metering accomplished without any extra line wires; coded operation control provides absolute protection against the possibility of false operation of any apparatus unit due to any foreign voltages on line wires; and the control is fast, positive, inherently antipumping and automatically checks itself.

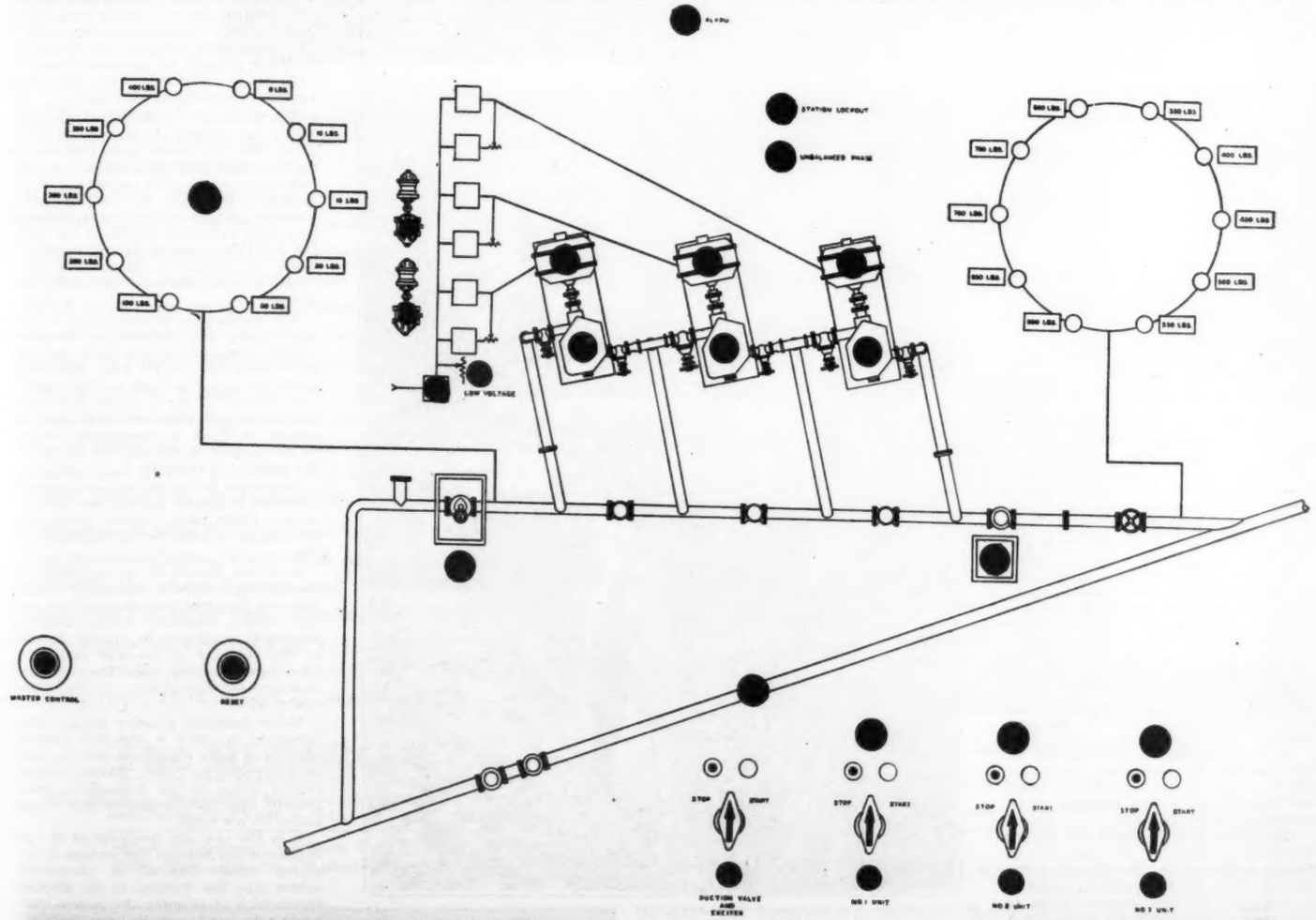
By this type of remote control the dispatcher operates the equipment in a manner similar to the way in which a station attendant in the pump station would locally control the apparatus by means of the usual station switchboard. In other words, instead of the operator throwing switches and other apparatus in the station the dispatcher can perform each of these separate operations in their proper sequence from his office located at distances of several hundred miles from the pump station. The system has been in actual operation on a circuit over 350 miles in length and there seems no mechanical reason for limiting the distance between station and dispatcher's office to any distance, economic conditions alone limiting its use.

The equipment is composed entirely of extremely simple relays, requiring a very small amount of occasional maintenance, there being no complicated mechanical parts requiring frequent inspection, oiling, adjustment or replacement. No polarized relays are used.

The equipment is mounted on neat steel panels which give the installation a compact, readily accessible assembly which occupies a very small space, facilitates installation and allows the equipment to be lined up with an existing switchboard.

Relay Equipment

The "all relay" system uses relays exactly similar to the ones originally selected by Westinghouse engineers for supervisory control purposes and of the standard automatic telephone type. Forty-eight volts of direct current is required in the dispatcher's office and in each substation controlled. This energy should be obtained from a separate, ungrounded 24-cell storage battery because this source of



Panel board in office of pipe line company using supervisory control system at one of its stations.

power cannot, under ordinary conditions, be interfered with and cause interruption of service.

The system requires two line wires between the dispatcher's office and each substation to be remotely controlled. The line conductors can be of ordinary telephone size. Either open wire, telephone cable or a pair of wires leased from the local telephone company may be used.

The panel mountings in both dispatcher's office and substation is mounted on modern steel panels 16 inches wide by 90 inches high. All terminals are on the rear of the panels and the terminal boards are provided with suitable covers so as to present panels with both a dead front and dead back.

The supervisory control relays are assembled in dust-proof cast metal cases which in turn are mounted on the steel panels. The covers of the relay cases have glass inserts allowing the relays to be inspected without removing the covers.

Operation of Control

In general this apparatus functions in the same manner whether the operation is that of closing or tripping a circuit breaker, starting or stopping a machine, obtaining a remote metering indication, etc. Instead of the auxiliary interposing relay being operated directly by a local operator, it is operated by the dispatcher through the medium of the supervisory control to perform the desired operation.

To close the circuit breaker, the dispatcher sets the twist type control key, that is indicated in the row of four escutcheons at the bottom of the accompanying layout sketch, to the "close" position. This control key is marked with an arrow and mounted upon the escutcheon which controls the breaker, and above it are two circles labeled "stop" and "start." The control key is moved to the right to start operations and after it has been turned to position, and the movement recorded by the flashing on of the "disagreement" light above the key, the next thing the dispatcher does is to depress the nonlocking, push type, individual master key shown in the sketch at the extreme left.

This action sets the proper circuits in action to "close" the proper master switch interposing relay thus closing the breaker. This is indicated to the dispatcher by the changing of the individual indicating lamps on the same escutcheon from green to red. The method of tripping the breaker is the same except the twist type control key is moved over to the "stop" position, or left, before depressing the individual master key.

When the dispatcher pushes the individual master key for a given breaker, that in turn starts or stops a pump motor, an individual point relay becomes energized. This in turn sets the dispatcher's transmitting relays into operation, which send a predetermined code of impulses over the two line wires to the remote pump station.

Each individual master key for each breaker has associated with it an individual "A" point relay and each of these relays in turn controls a certain predetermined code of impulses which is automatically sent out by the transmitting relays at the dispatcher's office when a given individual master key is operated.

If several pumps in one station were to be started up at approximately the same time the several master keys operating each pump unit are depressed in succession, only the code for the first key operated is sent out, the action of depressing the other keys having no effect under such circumstances. After this action is completed the remaining pumps may be started in sequence by the same method.

At the pump station the receiving relays register the code from the transmitting relays at the dispatcher's office and energize the proper selection relays corresponding to the code.

The system is so arranged that as the individual master key for each of the pumps is pressed by the dispatcher the two line wires are automatically switched by means of the line transfer relays at each station, to connect the transmitting relays at the pump station with the receiving relays at the dispatcher's office.

The predetermined code associated with the particular pump to be started or stopped will energize the selection relay in the dispatcher's office. This is indicated to the dispatcher by the lighting of the lamp on the escutcheon for breaker. In this manner the dispatcher is assured that the proper selection relays associated with the breaker for each pump in both stations have been energized.

Other operations follow, each consisting of alternately sending a predetermined series of codes for that particular operation. The entire sequence is completed in a few seconds, giving a speedy and positive control. Each code must be completed correctly or no operation will take place. This gives absolute protection against the possibility of wrong selection and false breaker operation due to the application of foreign voltages on the line wires from external sources, such as induction from adjacent high tension lines or by lightning.

A bell alarm, or light signal, is provided which operates whenever a breaker is tripped by any other means than control from the dispatching office. The bell alarm operates until cut off by the dispatcher operating the master release key. The breaker which tripped out is indicated to the dispatcher by the lighting of both the "disagreement" and stop lamps on the escutcheon associated with that breaker. The "disagreement" lamp is the one shown in the sketch above and to the left of the switch and marked with a dot and is so called because it will light if the position of the control key is at "disagreement" with the position of its corresponding apparatus unit.

System Installed Near Tulsa

The Sand Springs pump station of the Texas Empire Pipe Line Co., located approximately 15 miles from Tulsa, is operated by the Westinghouse Electric & Manufacturing Co. system, known by the trade name "Visicode" with the operator's panel in the office of the dispatcher in the Philtower Building, Tulsa.

In the pump station there are three 800 horsepower motor driven centrifugal pumps with the other equipment common to main line pump stations such as suction pumps, motor operated gate valves and pressure recording systems, all of which are made visible to the dispatcher in Tulsa through the system of lights as indicated on the sketch of the supervisory control accompanying this article.

The building is divided into two main rooms, one housing the pumps and equipment, while the smaller room contains the main automatic switching apparatus with protective relays, the excitation motor generator sets and the contact-making pressure gauges. The motor operated gate valve is located outside of the building and this is opened by remote control before the pumps are started, and closed by the same system after they have been stopped.

The system is so arranged that in case of necessity the operator at the Sand Springs pump station can start and stop the pumps and control other operations there by operating local controls within the station. If for any reason he does change the operating conditions the dispatcher in Tulsa is immediately notified by the change in the lighting system on the panel in his office.

Protection to the station equipment is provided to guard against low voltage, reverse phase, phase balance, overheating of motors, overheating of bearings and fire.

A unique feature of the equipment is the automatic remote indications of suction and discharge pressures over the two line wires. Ordinary remote metering equipment could not be applied because of the necessity of constant indication. This would require more line wires or superimposed frequencies on the supervisory wires.

Motor operated pressure gauges were developed to follow a standard pressure gauge and make contacts which, in turn, send impulses to Tulsa. These impulses control lamps on the dispatcher's board and in this way pressures are transmitted to his office.

It is felt that the development of this apparatus has reduced the problem of applying remote control to electrically driven pipe line stations to the simplest requirement of choosing the proper automatic devices and protective features for the equipment to be operated.

MANY USES FOR COMPRESSED AIR IN PIPE LINE CONSTRUCTION WORK

Pneumatic tools have long been used in all industries for many operations formerly done by hand, and in pipe line construction the contractors were not long in adapting to their needs much of this equipment. In industrial plants air is compressed in standard type stationary machines but it has been necessary to develop smaller units for pipe line construction work that can be moved readily along the right of way.

One type of portable compressor that is meeting with much favor for this kind of service weighs about 1,000 pounds and has a capacity of 142 cubic feet per minute at sea level, with a pressure of up to 125 pounds. The power is secured from the engine on the tractor on which the compressor is mounted, and transmitted by V belts. The compressor is air cooled with finned aluminum alloy cylinder heads and manifold resulting in the use of fewer parts and a reduction in weight.

Some of the uses to which this type of compressor is being put are operating chipping hammers, grinders and similar equipment for smoothing rough spots at welds. Air operated rotary brushes are used for cleaning the pipe of dirt and foreign material. For cleaning the pipe of corrosion products it has been found that sand blasting is most efficient and the air is used for spraying the sand against the material being cleaned.

Having cleaned the pipe the painting is done with spray guns and this has been found quite satisfactory and is being used by a number of the major pipe line contractors and pipe line companies.

Where it is necessary to drill holes preparatory to blasting rock the air drill is most efficient and furnishing air for this work is another use to which the output is being put. Tearing up paving where it is necessary in order to lay pipe is also done with air drills. An air-driven chain saw is being used by pipe line companies for felling trees along the right of way.

Compressed air has recently come into use in pipe line operation for emptying lines of oil. Instead of pumping oil out of a long section of line ahead of a water plug to make ready for repairs, or draining the oil in the line out onto the ground, it has been found that if the line is plugged on the upstream side of the break or place to be repaired and an opening made in the pipe for air connection it is possible to force the oil ahead of the compressed air pumped into the line. In this way the oil is forced beyond the point to be opened and into tanks at the nearest pump station.

In such operations capacity and air pressure must be carefully predetermined but the smaller portable compressors can be used for the blowing of the smaller size lines and for short lengths of large diameter lines.

The portable compressor is used for many other operations along pipe lines. Because of the character of the surface of the average right of way the tractor-mounted type compressor will win favor for it can be taken close to the work and this will avoid laying of long lines or carrying excessive length of air hose for the compressed air from machine to tool or other pieces of apparatus to be used.

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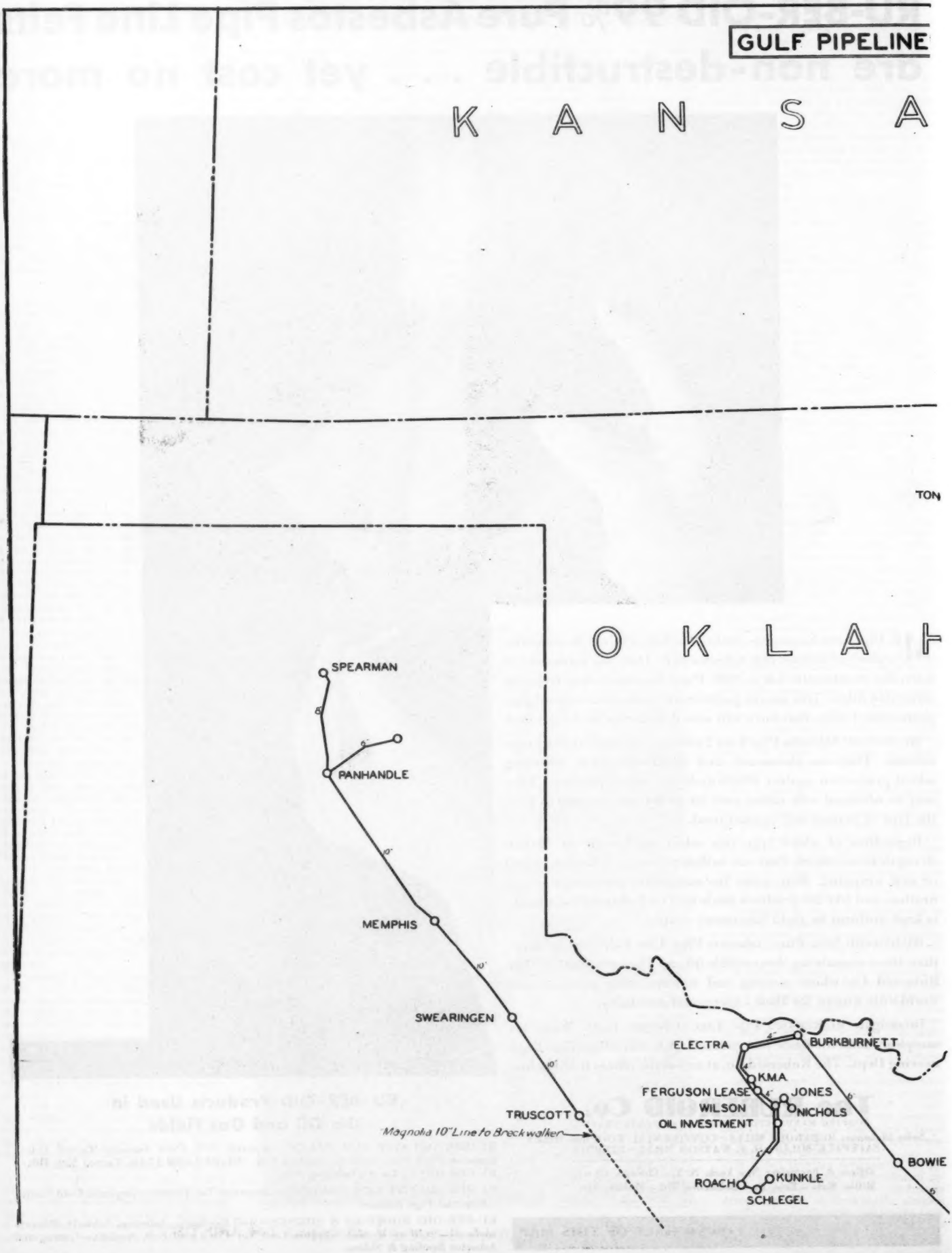
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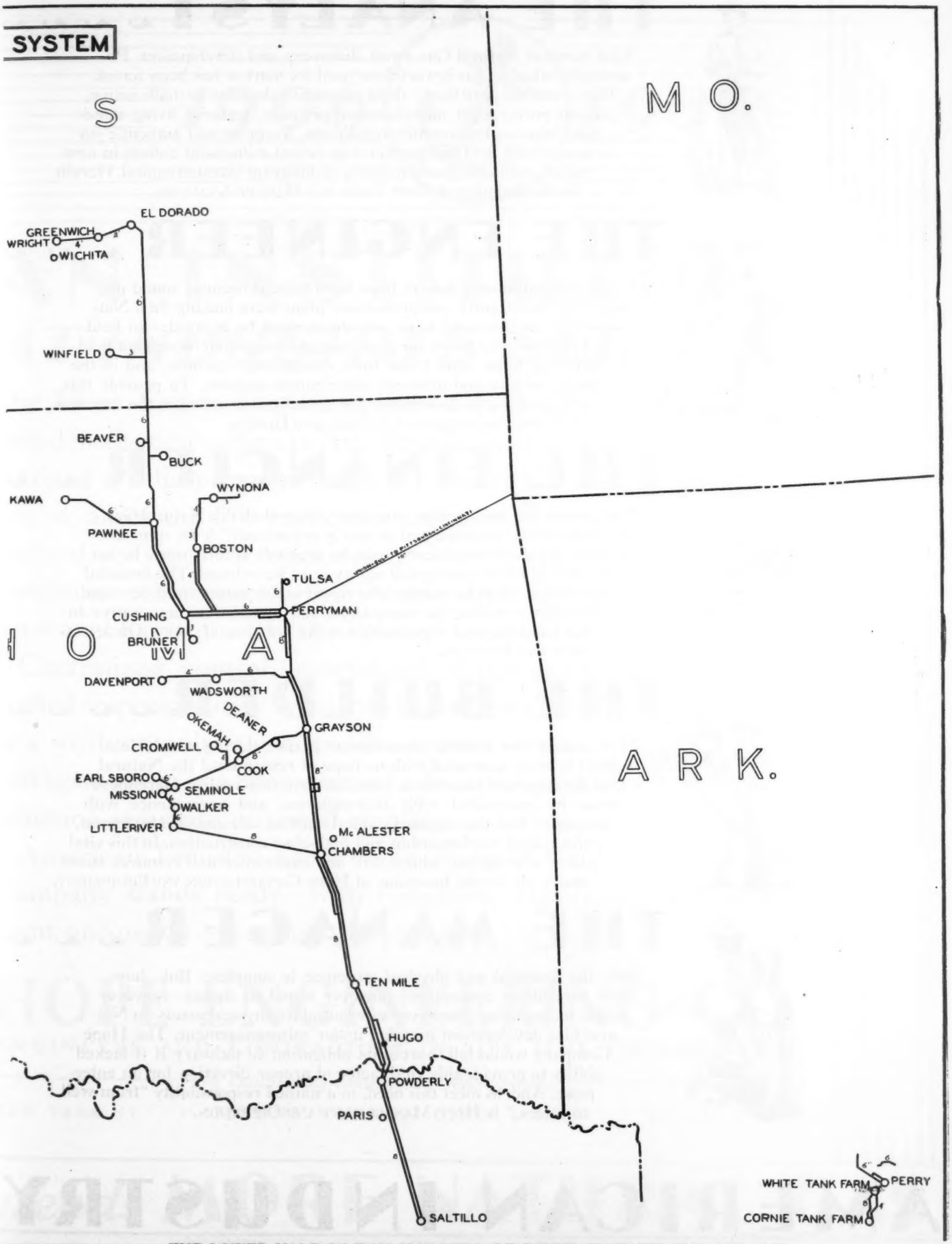

THE LOWER HALF OF THIS MAP WILL BE FOUND ON PAGES T-56 AND T-57

THE ANALYST

Vast stores of Natural Gas await discovery and development. Potentially valuable, gas is worthless until its market has been found. Then—and not until then—these potential values can be made active, in heat, power, light, manufactured products, bettered living standards, improved community conditions. Accurate and authentic surveys of both field and market may reveal millions of dollars in new values, will safe-guard millions of dollars of invested capital. Herein lies the function of HOPE FIELD AND MARKET ANALYSIS.

THE ENGINEER

Uncounted millions of dollars have been wasted because sound design and intelligently comprehensive plans were lacking. In a Natural Gas development, basic soundness must be assured:—in field and right-of-way work for pipe lines; in design and location of field gathering lines, main trunk lines, compressor stations; and in the layout of city and inter-city distribution systems. To provide this safe and secure foundation for actual construction is the function of HOPE ENGINEERING COUNSEL AND DESIGN.

THE FINANCIER

Next arises the momentous question—"how shall this Natural Gas development be financed and properly organized?" Vast sums are usually involved; confidence must be created; credits must be set up; men of repute and tested ability must be enlisted. The financial foundation must be stable—the corporate structure must be sound. To aid in providing the connections and associations imperative in this financing and organization is the function of HOPE ORGANIZATION AND FINANCE.

THE BUILDER

Then comes the critical construction period, during which time capital is being expended with no hope of return until the Natural Gas development becomes a completed physical reality. Here speed must be reconciled with thoroughness, and permanence with economy. For the invested capital must be safe-guarded by honest, pains-taking workmanship and high-class construction. In this vital phase of progress, where skill and experience and resource count above all, lie the functions of HOPE CONSTRUCTION AND EQUIPMENT.

THE MANAGER

Now the financial and physical structure is complete. But—however careful its conception—however sound its design—however stable its financing—however substantial its physical assets—a Natural Gas development may fail under mismanagement. The Hope Company would fall short of its obligation to industry if it lacked ability to provide this vital factor of proper direction for an enterprise. And, to meet this need, in a unified responsibility "from well to meter," is HOPE MANAGEMENT AND OPERATION.

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American Industry needs more Natural Gas; and the Hope Company stands ready—with resources, experience and equipment unequaled—to supply that need.

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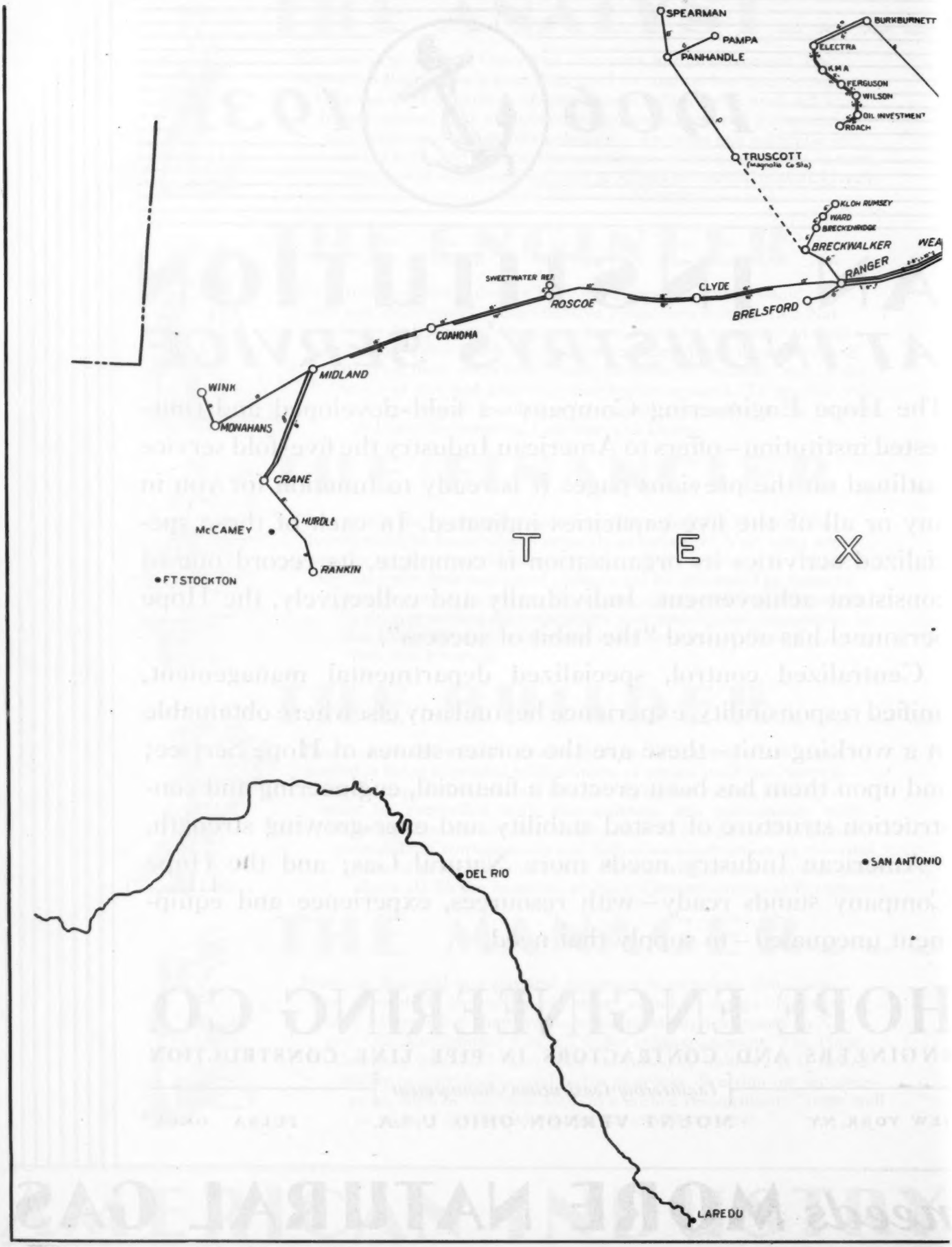
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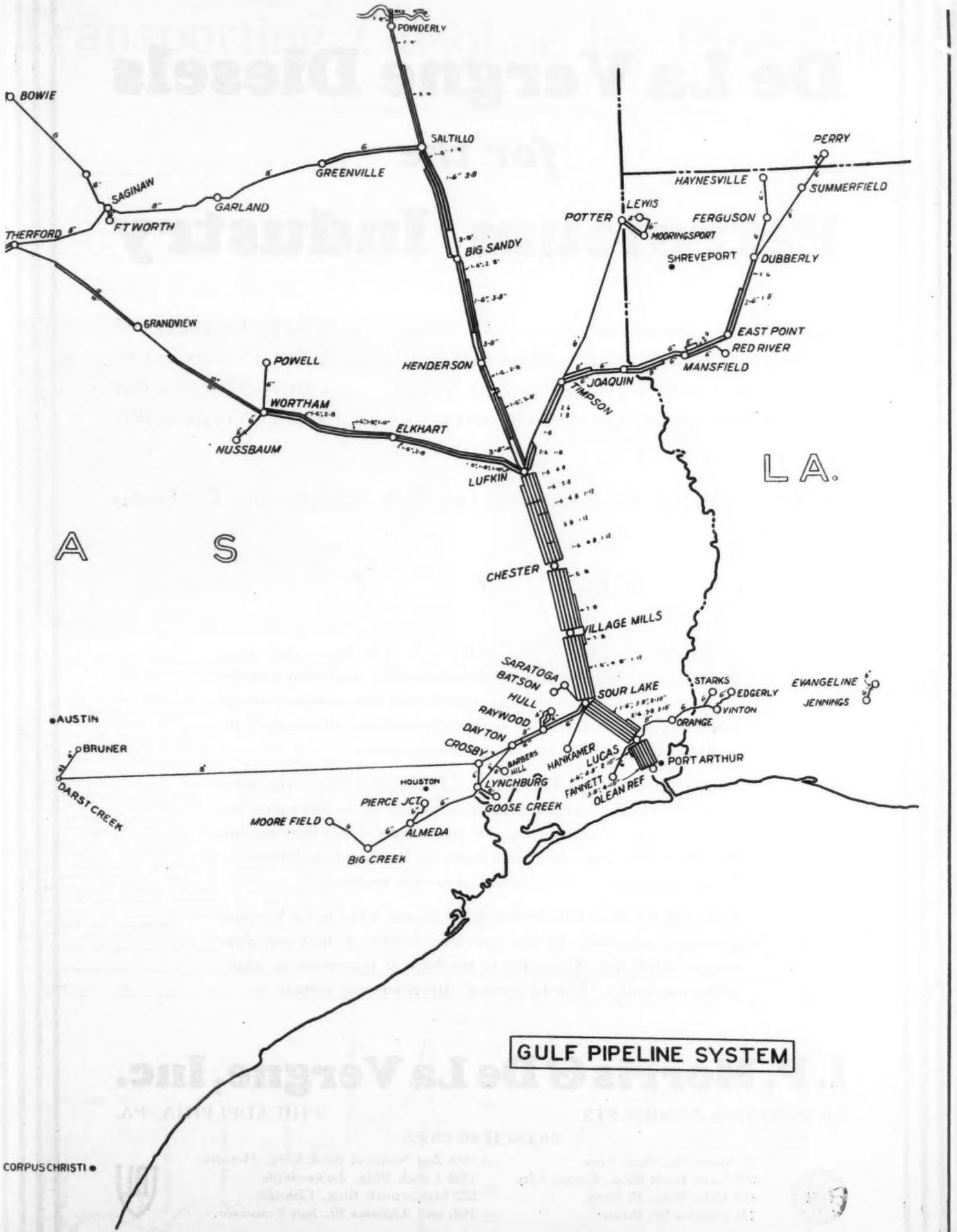

GULF PIPELINE SYSTEM

THE UPPER HALF OF THIS MAP WILL BE FOUND ON PAGES T-52 AND T-53

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Transporting Gasoline By Pipe Lines

Pioneer, Long Distance Project of Shell Company Has Been Highly Successful. Leaks Can Be Discovered Easily

By Frank R. Young
Pipe Line Dept., Shell Oil Co., Los Angeles

The oil and gas industry has within the past few years witnessed the development of a new member to its family, namely the "natural gasoline industry."

The growth of the "natural gas" industry has carried along with it the "gasoline" branch, the rapid development of extraction methods has brought necessary improvements in storage and transportation methods.

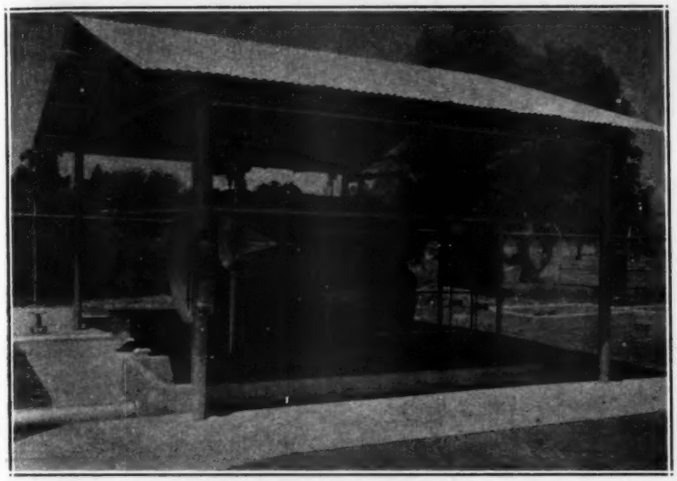
Gasoline extraction plants have attached themselves naturally to the areas closest to centers of gas production because of the difficulties of transporting "wet gas," so we now come to the matter of transporting the resultant product "natural gasoline," safely and economically. In California this development has been rapid in recent years.

The Shell Oil Co.'s natural gasoline pipe line from Ventura to Wilmington is now four years old. A discussion of the design, construction and operation of that facility is interesting and may be profitable in as much as it is considered as being the pioneer in the field of long distance transportation of gasoline by pipe line. Shorter lines of course had been in operation but shipping gasoline by pipe line had been generally confined more to refineries and short field lines.

Practical and Economical

No longer is there any question as to the practicability or economy of transporting gasoline by pipe line, provided gasoline in sufficient quantity in one locality is required over a long enough period of time in another locality.

Nor is this transportation limited to natural gasoline. We now have commercial grades moving from the centers of manufacture through pipe lines many hundreds of miles in length to the markets and it seems reasonable to predict that as time goes on, more of these lines will be built.



The liquid level automatic control apparatus is located outside of pump house, all pipe lines, valves, etc., being exposed.

If the Ventura gasoline line were to be duplicated today some changes would no doubt be made. Different materials are avilable now as under A.P.I. standardization the grades of steel for pipe are brought under closer control. The protective coating then used was considered adequate but present day methods of soil analysis would very likely call for a treatment against corrosion which would result in lower maintenance costs.

In undertaking the design of this pipe line it was quickly discovered that very little in the way of published data on gasoline pressure loss was available. Research into the performance of the then existing lines was not very satisfactory. The Shell company had for some time been operating a natural gasoline line from Brea to Wilmington, some 30 miles long but the Brea line was composed of various diameters of pipe which made extremely uncertain any definite conclusions as to pressure loss mathematics.

The solution of the problem was accomplished by going back to fundamentals; by reasoning that the viscosity of gasoline might, for friction pressure loss purposes, be considered approximately the same as that of water and at the same time taking into account the lower specific gravity of the gasoline. This proved to be the correct solution and later investigation has developed constants to be applied in hydraulic formulas which enable the engineer now to calculate gasoline pressure losses to a remarkable degree of accuracy.

In the Ventura line problem Williams and Hazens' formula was used to determine the friction head loss, the constant employed being C=140. After converting the foot head loss to pounds pressure loss for water, a reduction was made to compensate for the lighter weight of the gasoline by using the specific gravity of the gasoline as a multiplier.

The hydraulic problem was developed along the usual lines employed in water line design. A ground profile of the route was prepared below which a power profile was drawn representing the static pressure of gasoline. Hydraulic gradients based on the friction pressure loss developed flow characteristics for the quantities under consideration and the economic balance between pipe size and pressures was thus determined.

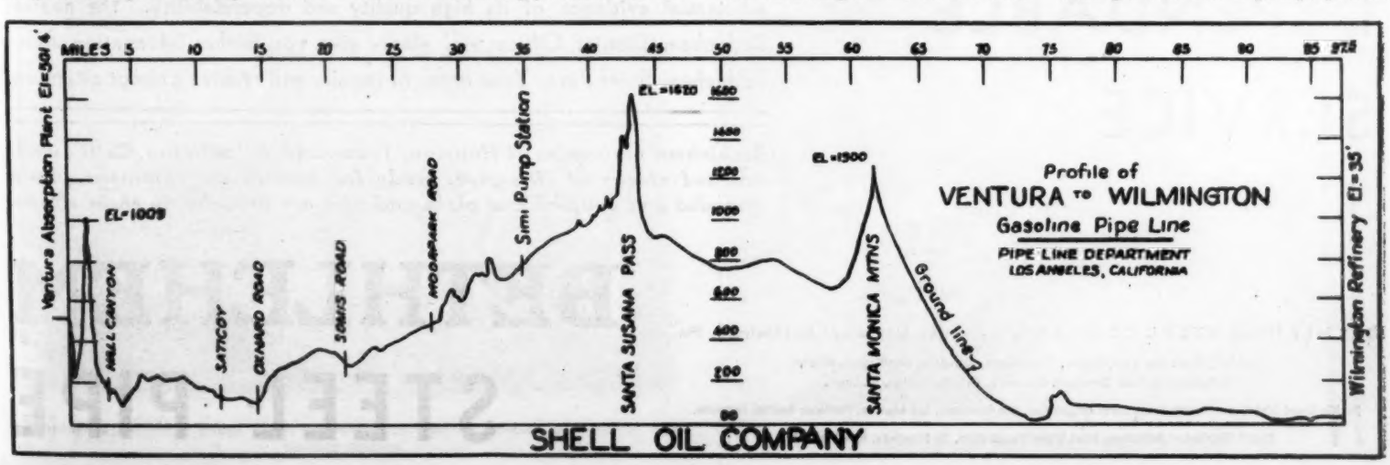
It is interesting to note that the theoretical pressures worked out by Williams and Hazens' formula were later checked against operating pressures and found to be within about 3 per cent of agreement. Studies of pressure performance have since been made under various operating conditions and these have developed a closer figure for Williams and Hazens' "C." It should be possible now to undertake the design of a gasoline pipe line with the same degree of accuracy that would be expected in a water line problem.

The Ventura line is 97.32 miles long and was constructed in 63 days elapsed time. This includes about three weeks heavy storms which delayed completion at least two weeks. The terrain over which the line ran was not by any means ideal. The profile shows three major elevations, necessitating a considerable amount of hand work as all material, pipe, paint and welding equipment was carried in by hand over parts of these inaccessible mountains.

The location avoided, as far as possible, all major highways, the object being to lay the line where it would be subject to the least disturbance later and where repairs could be made most economically.

The elevation of the Ventura pump is 475 feet and the Wilmington end is about 25 feet. The highest elevation reached is 1,620 feet, where the line goes over Santa Susana Pass. The Santa Monica Mountain elevation is 1,300 feet from which point the line drops rapidly to its

Simi booster station showing layout, aboveground lines and automatic control apparatus.



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BETHLEHEM STEEL PIPE

lowest elevation, 12 feet at Ballona Creek, near Culver City.

This was the first major trunk line in which seamless steel pipe was used in this country. The pipe was manufactured by the Mannesmann process of Siemens-Martin steel having a tensile strength of 90,000 pounds. Forty-foot joints were supplied which materially reduced welding costs.

Two pump stations operate on this line, the initial station at Ventura and a booster at Simi. Eight-stage multiplex centrifugals are used in both stations, the Ventura pump being driven by steam turbine, while the Simi booster is electrically operated. A stand-by pump was installed at each station.

One of the most interesting features in connection with the Simi booster station is the fact that it operates automatically. In order to retain the incoming pressure at Simi and to avoid evaporation losses which would result by use of an open surge tank, a boiler riveted steel pressure tank was installed into which the incoming stream is conducted. Three float cages are attached to the pressure tank and they are actuated by the gasoline within the tank. Two of these floats are set to operate a mercury switch which stops and starts the motor automatically, the other float being connected to a ball bearing throttle valve on the discharge line. These valves and floats are so set that a constant governable quantity of gasoline is kept moving through the Simi booster station at all times.

This automatic feature has during the past four years been entirely successful. The Simi station stops and starts itself and regulates its outgoing pressure without attendance. It has been confirmed that liquid level control is necessary in an installation of this kind. A control based on pressure alone would hardly be feasible where the combination of light natural gasoline and centrifugal pumps are used for the reason that gas pressures are built up in the pressure tank some time before the liquid arrives at the station. This means that with a pressure controlled station the pumps might be started before there was any liquid to pump and of course a high speed centrifugal would be ruined if it ran dry any length of time.

The first gasoline was moved through the Ventura line in March, 1927, and operation has been continuous since that time.

The line was originally calculated to handle 150,000 gallons of natural gasoline per day and has averaged in actual operation about 4,500 gallons above the estimate. By pumping straight through from Ventura to Wilmington, by-passing the Simi booster, the throughput is 112,000 gallons per day with slightly higher pressures at Ventura.

No Air or Gas Lock Trouble

No trouble with air or gas locks has been experienced, probably because air bleeder valves were installed on all high points and particular care was taken, when starting the flow, to bleed off all air and gas. This bleeding was only necessary on the initial start off, no air trouble having been experienced under normal operating conditions. Water was used for testing when the line was constructed and half-inch bleeder valves were installed in low spots on the line through which the water was drained off. Repairs sometimes necessitate flushing out a section of the line with water and it would seem to be in good practice to install bleeders at all low points along a line in order to drain off water which might get into the system. Otherwise water pocketing in low places will restrict the gasoline flow.

One of the important features of operation is the line patrol. In the average crude oil system, line riding becomes a more or less routine affair. A crude oil leak quickly makes itself evident by appearing on the surface of the ground where it may plainly be seen, but a small gasoline leak might remain undetected indefinitely unless diligent line walkers were constantly on watch. One of the best means of locating small leaks is by the presence of dead vegetation over the pipe line. In the Ventura line minutely small leaks, hardly more than sweats have been found by noting a small patch of dry grass surrounded by green vegetation, but the success of this feature of gasoline operation can only be attained by alert intelligent men who are trained in their work.

Inquiry has been received from eastern sources as to the attitude of right of way grantors on the hazards of gasoline pipe lines. So far as is known there has been no difficulty in California in securing locations for gasoline lines and rightly so, for the history of the oil industry in its handling of this highly inflammable commodity is one of which we may all be proud. When it is considered that gasoline is moving over our highways and railroads 24 hours a day in trucks and tank cars with remarkably few accidents, the transportation of the same fluid through pipe lines underground would seem to be a step forward from the standpoint of safety to the public and to the industry at large.

Recondition Line By Welding Collars

Saving Effected by Reduction of Leakage Paid All Costs of Work in One Year. Line Operated While Welding Was Done

By E. L. Adams
Superintendent of Pipe Lines, General Petroleum Corp. of Calif.

Screwed pipe lines have been subject to collar leaks and where hot and cold oils have been pumped alternately, such trouble has been greatly increased. When the oil handled has been fuel oil or heavy crude, many screwed lines have operated for years without undue loss of oil or excessive cost for repairing collar leaks, even when both hot and cold oils have been alternately pumped through the lines.

When, however, it is necessary to convert an old screwed line to gasoline or similar service, excessive trouble with collar leaks is usually experienced. One such change was necessary on the main line of a California pipe line company about five years ago, and to overcome the excessive loss a method of welding the collars solidly to the pipe was developed. This company now has between 100 and 200 miles of 8-inch line so welded. Considerable anxiety was felt at first as to the strength of the finished job, but experience has proven that the line with the collars electric welded is in all respects the equal of any other welded line.

No Operation Interference

The electric welding of collars is performed without interfering in any way with the continuous operation of the line at full pressure. In fact we consider it safer to weld on an operating line than on one that is shut down. Ordinarily one bead only of welding metal is run between the collar and the pipe, but an exception is made where a leaking collar is encountered. The collar leak is caulked ahead of the welding bead and after the bead is complete a second bead is placed entirely around the pipe. This is necessary because the first electric welding in the presence of some oil does not seem to stick perfectly, but once a temporarily tight bead has been welded the second larger bead is not affected by oil.

Ordinarily bell holes only are excavated at the collars, but occasionally where sections of line will need treatment for corrosion in the near future, the line is brought to the surface and both the welding and re-treating done as one job. In this case the arc welding machines are useful for welding on patches or building up metal over incipient pits, etc.

In the experience of this company the loss of oil or gasoline saved through the welding of the collars, more than paid in one year for all the work that has been done. Many leaks have been measured as large as 4 bbls. per day that would never have shown on the surface of the ground. On one 7-mile stretch of line on the low-pressure end of the line each leak that was actually dripping was measured. The total measured loss per year was more on this 7-mile stretch than the cost of welding the collars. On the high pressure end of a line the leakage is usually much greater. In addition to the saving in loss of oil the maintenance cost on the line was materially reduced. Past records showed that many leaky collars had been dug up and recaulked many times, but there has been no further trouble once the collars have been welded. It is now standard practice with this company, when a collar leak is found on any screwed line to electric weld that collar before the bell hole is refilled even though the bell hole must be kept open for some time before an arc welding machine is available.

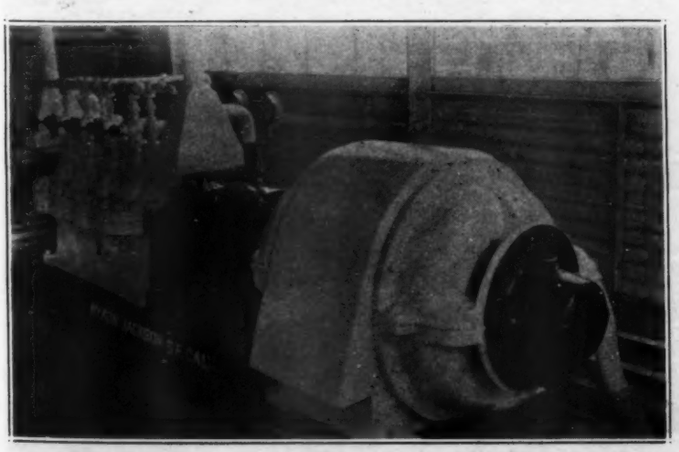
Welding All Collars

The crude oil now produced in the Kettleman Hills fields is the same as gasoline as far as leakage is concerned and the handling of Kettleman Hills oil through this same system for the past two years has necessitated continuing this welding of collars. It is contemplated continuing the work until the entire line handling such oil is welded.

The costs of this work may be divided between excavation, preparing the collar, welding, and backfill. Of these costs welding should be much the same on any 8-inch line. The other items will vary. This line was originally wrapped, the wrapping being especially heavy at the collars. This covering has to be removed and the collar burned clean by an acetylene torch. The bell holes on this line are being roughed out by a small gasoline engine driven shovel and finished by hand. The backfilling is being done by a caterpillar and push type backfiller. The welding is at present being done by two welders with one helper serving the two. The two welders and one helper weld 24 collars in eight hours. We have at times operated with machines which would supply but one welder at a time. In that case one welder with a helper welds 12 collars in eight hours. However, we have found that by replacing the helper by a welder and using two welders with no helper with a single machine, we can weld 16 collars in eight hours. This because a welder cannot electric weld continuously for eight hours, but where one welder acts as a helper half of the time or on alternate collars, it is possible to keep the welding operation continuous for the eight hours.

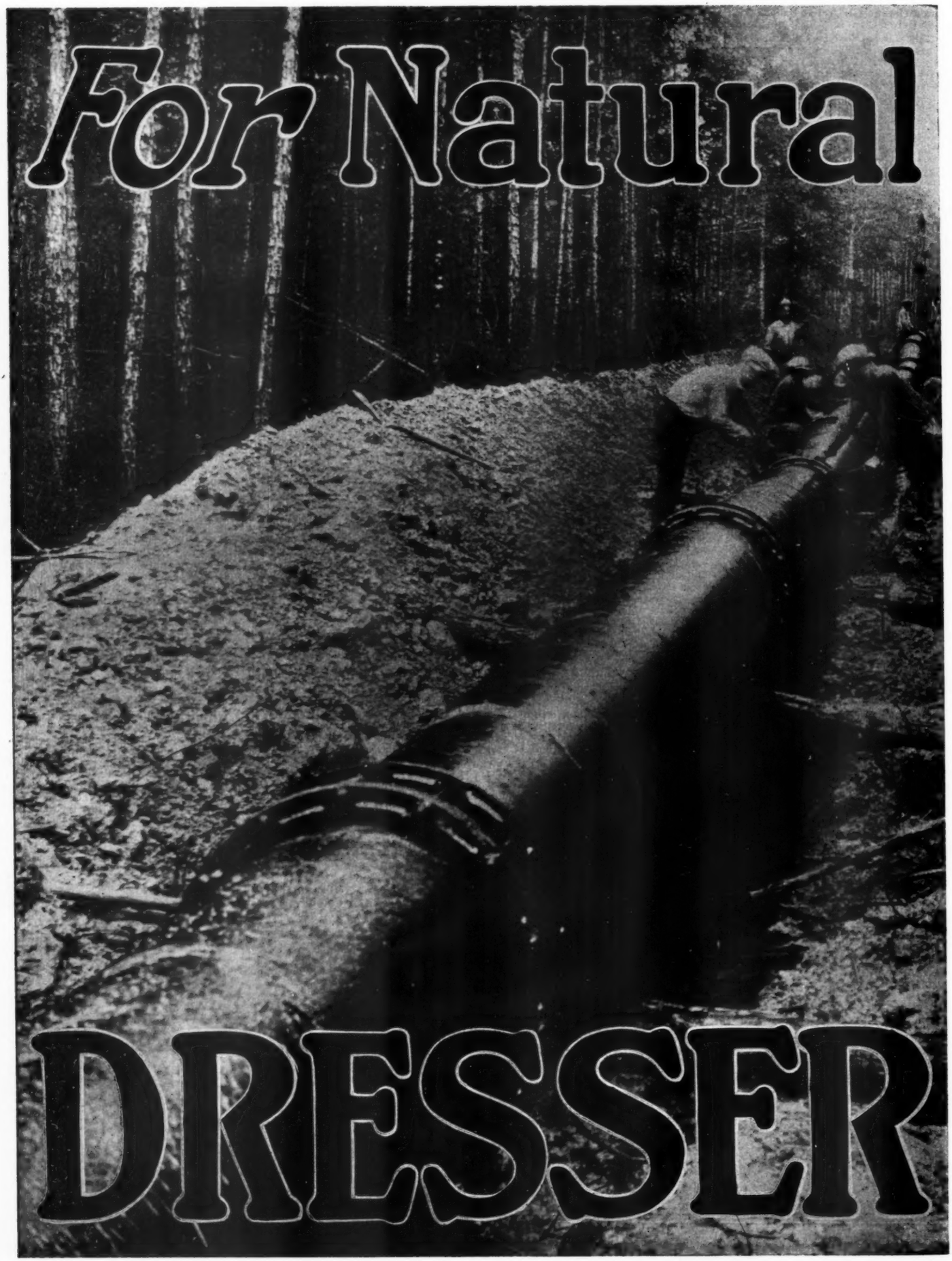
Our present cost on this type of work is as follows:

Each bell hole complete is costing	$ .62
Cleaning each collar is costing	.28
Welding both sides of one collar, including depreciation of welding machine	1.33
Backfilling, per bell hole, costs	.22
Total per collar	$2.45



Eight-stage centrifugal pump direct connected to 440-volt motors as used at Simi booster station.

Lowering pipe with tractor, winch and boom.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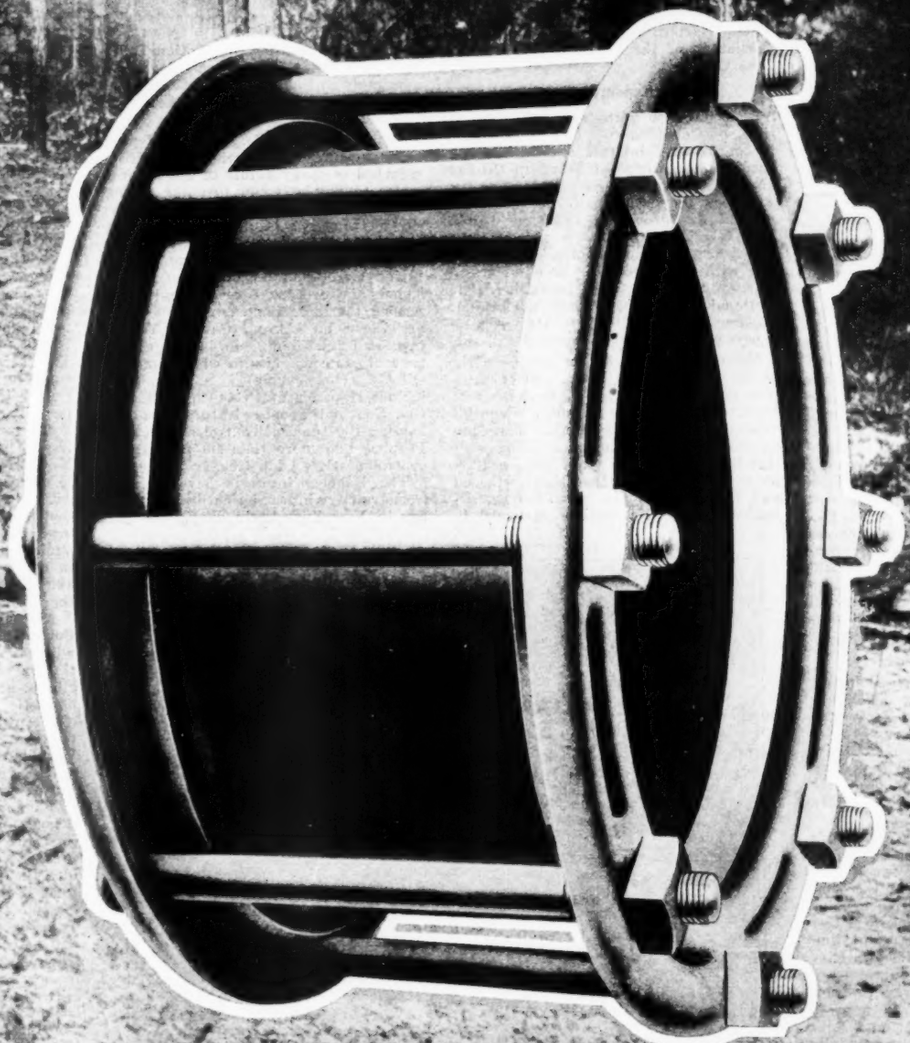

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COUPLINGS DOMINATE!

Natural Gas Lines Reach East Coast

Big Expansion, Started in Southwest, Making Itself Felt Throughout Large Eastern Industrial and Domestic Centers

By A. E. Mockler
New York Bureau, The Oil and Gas Journal

Natural gas for industrial consumption will reach New York some time this year. It seems Columbia Gas & Electric Corp. will be the winner in the race to be first to supply natural gas to the largest consuming center on the Atlantic Seaboard, and the lineup indicates that Public Service Corp. of New Jersey and Consolidated Gas Co. of New York will be the marketers of this product working in conjunctoin with the Columbia company.

With long distance transmission of natural gas thoroughly demonstrated as sound from the commercial standpoint, a general influx of natural gas lines to the rich eastern seaboard area has got under way, and while New York is the "plum" in this business, there are many smaller, but rich markets, to be taken care of in the progress of natural gas pipe lines to the metropolis.

Columbia Gas & Electric Corp. indicated several years ago that it was contemplating the invasion of eastern seaboard markets with natural gas, and assured itself of a transmission system by purchasing sections of unused oil pipe lines running to within striking distance of New York. The company also is constructing a gas pipe line from West Virginia to New York City. This line has already been completed into the District of Columbia, where natural gas, drawn from West Virginia fields, is sold by Columbia Gas & Electric to the Washington Gas Light Co., which recently commenced the distribution of natural gas in the District of Columbia. This new line, running east via Coatesville, Pa., represents the first extension of natural gas transportation to the Atlantic Seaboard. The line, when completed, will be approximately 500 miles in length and will run to Newark, N. J., where it will hook up with distributing systems serving New York and New Jersey.

Offering Industrial Contracts

Public Service Corp. of New Jersey, which is expected to be the distributor for Columbia in New Jersey, is reported to be already offering contracts to industrial consumers in sections of New Jersey across the Hudson from New York City, with intimations that the service will be made available some time within the next six months.

While all of the Columbia company's recent energies have appeared to be centered in the West Virginia-Newark line, considerable interest attaches to the company's old oil line, running from a point adjacent to Olean, N. Y., to Saddle River, N. J., about 7 miles on a straight line to the New York side of the Hudson River. This pipe line affords the company a second valuable right of way to New York. The intense activity in natural gas production acitvities in northern New York, it is believed, affords new possibilities for this line as a natural gas carrier. This line could be readily utilized to transport natural gas to such cities as Elmira, Binghamton and Albany, N. Y., Scranton, Pa., and other points along the right of way, and, with the West Virginia line of the company, affords the Columbia company two paths to the New York market.

The West Virginia line of the Columbia company will witness the greatest expansion in the near future. This line branches into two sections, one, running as far east as Coatesville, Pa., now being used to transport natural gas to Washington, D. C., and the other link running into Philadelphia.

Baltimore is likewise in the Columbia picture, and negotiations are now under way between Columbia and Consolidated Gas, Electric Light & Power Co. of Baltimore for making natural gas available to that city.

In preparation for the expansion of its natural gas marketing activities the company last year organized Columbia Oil & Gasoline Corp. as a subsidiary, to operate oil properties formerly part of the Columbia Gas & Electric system. Following consolidation of the petroleum business of the Columbia system, the subsidiary company last fall extended its operations as well into the natural gas field, acquiring a half interest in the Panhandle Eastern Pipe Line, the principal subsidiary of the Missouri-Kansas Pipe Line Co.

Jersey Standard's Position

In connection with the eastern operations of Columbia Gas & Electric there is considerable interest shown here regarding the position of Standard Oil Co. (New Jersey) in the eastern gas picture. The New Jersey company has extensive natural gas properties in Pennsylvania and New York, and has a wide marketing system in Pennsylvania. In connection with this, there have been rumors in market circles recently indicating that National Fuel Gas Co., with Standard Oil of New Jersey affiliations, may become a part of the Columbia system.

National Fuel Gas Co. was formerly of the Standard Oil group, and operates through 10 subsidiaries in western New York, eastern Ohio, western Pennsylvania, and in Ontario, Canda. The company's operations continued along routine lines for several years, but in 1929 its activities were substantially widened and Iroquois Gas Co., a subsidiary, extended its pipe line system eastward to Dansville, N. Y., installing new gas distributing systems at Castile, Silver Springs, Nunda, and other points in Wyoming and Livingston Counties, New York, lying along the route of its pipe line. In the same year National Fuel Gas added more than 90,000 acres of gas lands and 65 miles of 6 and 8-inch gas transmission lines to its holdings, and the company is now in position to extend its distributing system to many points in New York State. The position of National Fuel Gas, it is pointed out, would lend itself admirably to linking up its operations in upper New York State with the Columbia system.

Standard Oil Co. (New Jersey), through other subsidiaries, is well entrenched in many points in the territory which Columbia is now invading through its eastern expansion program. The Jersey company is a leading natural gas operator in Ohio, West Virginia, and Pennsylvania, subsidiaries in this region supplying more than 650,000 domestic consumers in over 200 towns and cities. Among the more important cities served are Cleveland, Akron, Canton, Youngstown and Massillon, Ohio. Other eastern natural gas companies in which Standard Oil Co. (New Jersey) is a large holder include Hope Natural Gas Co., East Ohio Gas Co., and Peoples Natural Gas Co., holding 100 per cent control of Hope and Peoples, and more than 99 per cent of control of East Ohio Gas.

The Doherty interests have been extremely active in leasing natural gas acreage in New York State during the past six months, and are believed to have more than 500,000 acres under lease in New York State, with the company's plans calling for a substantial expansion in marketing operations in consuming territory within easy reach of its production.

Increased Consumption

A substantial increase in consumption of gas for domestic heating is looked for in Atlantic Seaboard territory with the advent of natural gas. While the present plans for the distribution of this fuel call for the blending of natural and manufactured gas for domestic consumption, it is believed that the added heat content of this mixture, combined with the attractive rates which gas distributing companies will be able to quote on large quantity sales, will materially stimulate consumption.

The present charge for manufactured gas in New York City is $1.15 per 1,000 feet, the gas supplied having 537 B.t.u. content. In Buffalo, N. Y., where natural gas with 1,050 B.t.u. content is supplied, the rate is 75 cents, less 5 cents, per 1,000 feet, with the minimum monthly bill $1. Rochester and Syracuse, N. Y., where manufactured gas is distributed, have rates of $1 and $1.13, respectively, per 1,000 feet for the first 20,000 feet per month used.

While it is not expected that the arrival of natural gas in New York and New Jersey will result in a substantial lowering of the basic rate for gas for domestic purposes, the added heat content of a blend of manufactured and natural gas which the local utility companies could make avaliable to consumers in this area would result in an appreciable saving to the consumer, as well as the furnishing of more satisfactory gas.

Although it is logical to assume that Columbia and its affiliated companies will concentrate their marketing activities on industrial consumers in this territory, at least for the time being, the domestic markets of the large eastern cities present an attractive opportunity for quantity sales, and it is believed that Washington, Baltimore, Philadelphia, and other large centers between the source of the West Virginia line and New York will be supplied as the Columbia system extends northward. While some interests have expressed the opinion that natural gas will push on past New York into the fertile New England industrial zone, it is believed that this development is some time away as yet, owing to the extensive development which Columbia will be called upon to carry on to supply New York and intermediate points along its new lines.

Despite the fact that general interest has centered on natural gas marketing developments in the middle and north Atlantic Seaboard, there have likewise been important developments in this field farther south. Southern Natural Gas Corp. has extended its line as far east as Macon, Ga. This company was organized in the summer of May, 1928, and in the following year started construction of an interstate natural gas line tapping the Monroe and Richland fields in Louisiana and transporting gas through Mississippi and Alabama to Atlanta, Ga. The company's lines supply natural gas to Birmingham, Yazoo City, and Atlanta. The company constructed another line running southeast through Jackson and Hattiesburg, Miss., and Mobile, Ala., terminating at Pensacola, Fla., but this line has since been sold to the United Gas Corp. During January of this year, sales of Southern Natural Gas Corp. exceeded 1,000,000,000 feet, and its volume is reported to have increased steadily since that time. The company is controlled by Tri-Utilities Corp., which is a G. L. Ohrstrom holding company.

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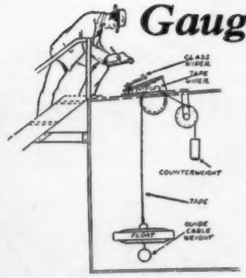

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O C E C O

Gas Line Crosses Continental Divide

Aeroplanes Marked Route; Roads Had to Be Constructed and Material Hauled 59 Miles. Other Problems Solved

By Walter Reid
Vice President and General Manager, Southern Union Gas Co.

The building of a 150-mile road that would permit of heavy hauling, a temperature with 45° variance between night and day and the laying of pipe across a country beset with canyons, numerous sierras and peaks belonging to the Rocky Mountain system, are some of the difficulties surmounted by the Southern Union Gas Co. of Dallas, Tex., in the construction of a 10 and 12-inch natural gas line from the Farmington, New Mexico, gas field to Albuquerque and Santa Fe, chief population centers of New Mexico. The line will be extended to Las Vegas shortly.

The line was constructed for the Albuquerque Natural gas Co., a subsidiary of Southern Union Gas Co., and is about 300 miles in length. It is the first gas line to cross the Continental divide. Construction was begun on the line last May and was completed in October.

Although much table land abounds in New Mexico, the route of the line passes through a section that is exceedingly rough, broken up with peaks, foothills, arroyos, ravines and canyons.

Material Hauled 59 Miles

A scarcity of towns along the 150-mile stretch between Farmington and Albuquerque made it necessary to haul pipe, provisions and water for considerable distances, as great as 59 miles in some instances.

Aztec, N. Mex., lying north and east of Farmington, is the uppermost shipping point on the line, La Ventana and Alameda being the second and third shipping points. La Ventana lies in the Nacimiento Mountains, one of a group of broken sierras extending southward from the Colorado line, and is the nearest railroad town to the midpoint of the line.

An airplane was used in conducting the survey for the line. The plane was first flown over the area to aid in selecting the best route. In a second trip, made in a direct line over the route, three prong aerial survey stakes resembling small hat stands, were dropped from the plane, which flew at an altitude of from 50 to 100 feet. Ninety-nine out of every one hundred survey stages stuck in the ground, according to those in charge of this phase of the work. Rags about a foot in length, tied to the tops of the stakes, provided excellent markers for the surveyors who followed along over the course of the line.

Built More Than 50 Bridges

It was found necessary on this project to construct more than 50 bridges spanning large arroyos and canyons. These bridges ranged from 10 to 150 feet in length. In constructing the bridges, piling was driven for the sake of giving permanence to the job.

The Kutz Canyon crossing was the most difficult. Here, instead of bridging the canyon, the sides were leveled away to provide passageway for the line.

Special pipe protective was used on the line across the Kutz canyon. This consisted of a paint job, followed by a burlap wrap and another coating of paint. Elsewhere on the line paint was the protective used.

In constructing the roadway between Farmington and Albuquerque, the actual construction of the road was kept 15 miles aread of the pipe stringing gang. There is a difference of 45° of temperature at this time of the year through the New Mexico section, between the days and nights, with the thermometer reaching 100° in the daytime and 55° at night. The altitude on the line ranged from 5,000 feet at Albuquerque to about 7,100 feet at Santa Fe.

This variance of temperature made it necessary to lay the pipe in units, connecting the units at night, following the contraction of the pipe. Under this plan 500 feet of pipe was connected and lowered into the trench in the day time. The next 150-foot unit was left at the side of the trench to be lowered at night. The line is acetylene welded except at points across exceedingly rough country, where Dresser couplings are used. All bends on the line are cold bends.

Acetylene Welded

The new Lindeweld process was used in the welding of the line and engineers state that it represents approximately a 40 per cent saving over the old Linde method. By the new technique, three welds are made on the 12-inch in an hour as against one weld in an hour by the old process. The 12-inch line, arriving in 20-foot lengths, was welded into 40-foot lengths as it was unloaded onto racks.

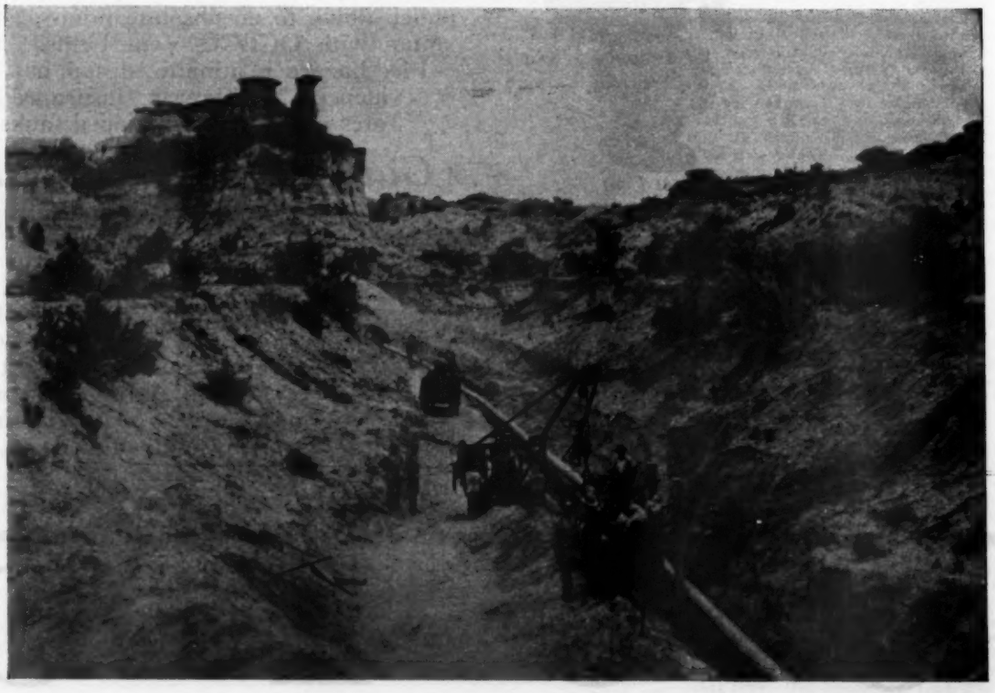
About 500 laborers worked on the project, the majority of them being Navajo Indians. Mexican labor and white labor was also employed. Of the latter group, a considerable number were college men, following the company's policy of hiring these men for the summer vacation periods. The Indian laborers were secured through a government Indian agency. An interesting fact about the Navajo laborers is that they prefer to sleep under the stars, rolled up in sheepskin blankets, rather than to sleep in the more luxurious surroundings provided by tents and bunkhouses which are utilized by the other laborers.

Three ditching machines were at work on the line and 30 very low-geared 3½-ton trucks were used in stringing the pipe. About 50 teams were utilized on the line, chiefly in connection with laying the road bed which is the only road in existence between the gas fields and Albuquerque. A telephone line was also constructed the full length of the line by the Southern Union. Holes for the telephone poles were driven with a post-hole digger which operated with power created by a tractor.

A special machine was used for boring under highways and under railroad crossings. The machine, which is also applicable to boring under concrete, was designed by engineers of the Southern Union and patents are pending on it. It functions similarly to a rotary drilling machine, but operates horizontally.

The Albuquerque Natural Gas Co., which operates the Mesa Grande Gas Co. and the Durango Natural Gas Co., both of Colorado, will operate the New Mexico line.

Dropping down into Kutz Canyon for the river crossing.



The tie-in crew joins the 200-foot sections and drops the pipe into the ditch. Notice the rough going at this point.

Problems in Gas Pipe Line Financing

Adequate Reserves, Long Term Sales Contracts and Returns Commensurate With Risks Are Few of the Requisites

By Leon R. Gurley
Consulting Engineer, Carl H. Pforzheimer & Co., New York

The natural gas industry had its inception in the middle of the past century. While its growth has been steady since that time, it was until recently an industry of many small units, each operating in a restricted territory. Gas was primarily a by-product in the production of petroleum and when it was not wasted it was used only in the immediate vicinity of a producing field. The history of the industry records that the first long-distance pipe line began operations in 1872, but an investigation showed that this was a 2-inch line extending 5 miles into Titusville, Pa., which would hardly be called a long-distance pipe line at the present time. Before many years, however, pipe line systems covered a great part of Ohio and Pennsylvania and natural gas was in general use both for domestic and industrial purposes. None of these lines was of any great length and are not considered in the same light as the projects of late years which transport natural gas in large quantities to consumers at great distances from the producing areas.

There are three great gas-producing areas at the present time. The oldest is the Appalachian region, which furnishes gas to the northeastern part of the United States. The Louisiana and Texas gas fields are now the largest in both area and production and control the market territory comprising the Mississippi Valley and the southeastern states while the California fields serve the Pacific Coast.

How Bankers Check Project

Several lines of 300 miles or more in length are in successful operation and many more are in the promotion stage. The success of most of these projects and the quietness with which the failures were reorganized have given to natural gas a great popularity with the investing public and the purpose of this discussion is to present in general the way an investment banking house checks up the financial feasibility of a proposed natural gas line. While the reputation of the banking house underwriting an issue will always have to serve the average small investor as his guarantee of the stability of the project he should at least understand the basic principles which determine the success or failure of the proposal.

The organization and financing of a natural gas pipe line project is little different in principle from the starting of any other commercial enterprise. The success or failure depends upon certain fundamentals which have not changed since the first business project was launched by some of our remote ancestors. These fundamentals may be summarized under five headings: Source of raw materials; operation; markets; management; and the financial structure which includes the factor of profit. A banking house which is considering furnishing the necessary capital for a natural gas pipe line looks at the project from these five angles and classifies them in this case as: Natural gas supply, pipe line construction and operation, market outlets, management and profit margin.

Welding joints of a pipe line.

Natural Gas Supply

The first requisite obviously for a natural gas pipe line is an adequate supply of natural gas and our duty is principally to define the word adequate, considering the special requirements of the particular project. The first requirement is that the gas field or fields supplying the project must be able to deliver, under any and all conditions, sufficient gas to cover the maximum demand of the pipe line. In explanation, let us assume a pipe line project with an average demand of 30,000,000 feet per day throughout the year. This demand will naturally vary from month to month and the maximum may be around 40,000,000 feet per day during January. In that case the gas supply must be capable of furnishing 40,000,000 feet per day at any time. Another vital point is the period of time during which the field will supply gas at the required daily rate. While the required life of the field will vary with the particular project, it formerly was determined by the estimated physical life of the actual pipe laid in the line. However, modern construction methods have seemingly extended this physical life so that it no longer is a definite factor. The banker need no longer care whether the pipe line and the field of supply will last 40, 50 or 60 years if the money he and his clients advance to the project will be repaid in 15 years. So from the banking house viewpoint, the economic life of the project is merely the life of the securities which it purchases plus a certain period for a factor of safety. In general financial terms it may be said that this minimum life of the gas-producing field is that period which will be required to pay off and retire all securities ahead of the common stock whether they be bonds, notes or preferred stock. The consequences to the bondholder when 20-year bonds are issued on a 10-year gas supply are obvious.

This gas supply may be obtained from gas-producing properties owned directly by the pipe line company or it may be controlled by contract with a producing company. Due to legal complications all interstate pipe lines control their supply by contract, even though the contract be with an allied corporation. In either case the banker will demand a geological report covering the gas field which shows the supply to be adequate as defined above. This report will naturally have to be made by an impartial geologist whose integrity and ability are well known and above question. When gas is to be obtained under contract the producer of the gas must also be financially responsible to carry out his obligations under the contract.

Aside from the physical reports regarding the gas field, contracts or options must be at hand to demonstrate that the gas can be procured at a price which will permit the profitable operation of the business. This will be further discussed under the headings of profits.

After determining that there is a sufficient supply of gas for all requirements of the project, the next step is a study of the design and layout of the actual pipe line. The technical advisor in this respect must again be of high caliber to insure the confidence of the bankers. The engineering report covering the pipe line must show the route to be covered from the field to the market and this route must contain no unsolved physical construction or operating problems which would endanger the success of the enterprise and the right of way must be readily obtainable if not already procured. Any detailed discussion of layout and design of natural gas pipe lines would of necessity be technical and would be out of place here. However, the report submitted to a banking house must contain these technical details in order that the bankers' technical staff may check them thoroughly. In general, it may be said that this report must clearly demonstrate that the pipe line is of sufficient size to handle the amount of gas necessary, that it contains no construction or operating features of prohibitive cost and is capable of future increase in capacity through the installation of additional compressor stations in order to serve an expanding market. This report will contain the estimates of costs of rights of way, of construction and of operation and, as in the case of the gas purchase contracts, these costs must be sufficiently low to insure the profitable operation of the project.

Market Outlets

A natural gas pipe line company will ordinarily sell its gas only to large consumers such as local utility companies which distribute the gas in a city or town. Some contracts will also be made with large industrial users who are not located in such cities and can be served direct. While some other small markets will probably be served through political necessity along the pipe line they will be of doubtful value due to installation and service costs and will not be considered in the promotion of the project.

The market analysis covering the territory to be served must be very complete. It must show the communities to be served with their population figures, and a tabulation of the expected demand for gas by domestic consumers. This demand can be estimated with considerable accuracy by experienced gas engineers as it is based on weather bureau data and average family income figures as well as other information available from other utility companies serving these or similar communities. The market analysis covering the indusrial consumers will be more involved as industrial gas is in nearly all cases used directly in competition with another fuel. A careful study in each case will be necessary to determine whether or not the industry is a prospective gas user and what price it can afford to pay for gas in case it does become a customer.

Ready to cross the river.

A summarization of the above information will estimate the total amount of gas which might be sold within the territory but the conservative banker or investor will demand that the promoters of the project also furnish contracts, either final or tentative, proving that the possible market will become in a large measure immediately available. Since gas distribution in a town or city is controlled by franchise, it will be necessary to show a contract with the franchise owner to prove the availability of the market. The contracts with industrial consumers are necessary to prove that the proposed selling prices are in line with the costs of the competing fuels. These contracts must cover a minimum term of five years and should cover 15 to 20 years to guarantee the continuity of the market and to protect the gas pipe line investment in case of a price depression in an industry furnishing a competing fuel.

Not Sold on Price Alone

In many cases observed by the writer, the promoters of natural gas projects have attempted to compete with any and all fuels on a straight price basis. That not only places a burden on the project by increasing the percentage of gas sold at low prices but shows lack of experience on the part of the promoters. Natural gas does not have to be sold on price alone as it is without doubt a superior fuel. It will effect many economies in the operation of an industry other than in the item of fuel cost. Fuel handling labor will be eliminated. There is no need for labor or equipment to handle ashes or other residue. A certain percentage of the plant cleaning costs will be eliminated. Furthermore, there are certain industrials such as ceramics, glass, and some steel processing plants which can and will pay higher than a directly competitive price for natural gas as it eliminates many operating problems and hazards which are unavoidable with other fuels. The lack of consideration of these marketing features of natural gas results in a lowered revenue and may easily jeopardize the success of the undertaking.

The final summary of the market analysis must show the daily demand for gas by districts or communities and the corresponding revenue to be received. It must include a tabulation showing the growth of this demand from the beginning of operations until the maximum has been reached. Conditions should be such that this maximum will be reached within five years. If the growth of demand is too slow the accumulation of interest payments on the bonds or other senior securities will become such a burden that a reorganization may be necessary. Such reorganizations practically always result in a loss for the banking house or its clientele who furnish the money for construction.

Management

In spite of the fact that the success or failure of the project depends primarily on its management the qualifications necessary for success can be summarized in a very few words. The man-

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The courage and determination of many Public Utility Organizations and Oil Companies to go ahead with the construction of their planned pipe line projects, in the face of a major deflation period, has vastly reduced the total number of unemployed persons, and has been the Main Stay in our industrial structure during the past eighteen or more months as well as being responsible for laying the foundation upon which all Industries will be able to build upward again.

We suggest that every community now without gas service make a strenuous effort to have such service made available as quickly as possible, thus speeding up employment and bringing to their community the added convenience, comfort and economy afforded by gas.

No municipality should permit installation of gas supply systems without same being approved by competent engineers and constructed by responsible organizations who will not jeopardize the safety and health of persons dependent on such systems for continuous service by the use of questionable materials.

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agement must be known through experience to be honest, energetic and thoroughly capable. The banker will want to know the complete executive personnel of the proposed company as companies managed by one or two good men have been shown to be very hazardous enterprises. In such a case sickness or accident may quickly remove the mainsprings of the company and inexperienced subordinates will be unable to carry on in their absence. Able management must be available for all departments from the producing field to the final distribution.

Profits

After all of the above examinations have been completed the determination of the financial feasibility resolves itself into elementary arithmetic. The difference between the revenue received and the cost of the gas in the field added to the cost of transportation to market readily shows the margin of operating profit. This point is as far as the promoter of the pipe line company can go. The rest is up to the banker. The banking house must set up a financial structure consisting of issues of bonds, notes, debentures or preferred stocks with an underlying issue of common stock. The details of this structure will depend upon the state of the security markets at the moment of financing. While no two companies have had the same capital arrangement, all of the companies financed by public offerings of securities have followed the same general plan of setting up a senior issue of bonds or debentures approximately equal to the actual cost of the pipe line and then capitalizing the contracts and expected earnings through common stock. The period from 1924 to 1929 is a beautiful example of changing conditions in the security markets with a return swing of the pendulum during 1930 and 1931. One pipe line company which used a bond issue as outlined above was able to retire the bonds within two years with money raised by selling additional common stock. While the company's operations had been very successful during those two years it was able to do this refinancing primarily because of the increased market popularity of speculative common stocks as compared to bonds with their fixed returns. If the original financing had been deferred these two years it is entirely possible that the bond issue would never have been issued at all.

When a company expects to offer its securities to the public the bankers will make certain demands as to minimum immediate earnings regardless of the size of the ultimate profits. The bonds or other senior securities will, of course, draw interest from the date they are issued and since they will be issued before construction begins considerable time will elapse before the company is in a position to earn its interest requirements. The interest for the first year will have to be paid from working capital and that allowance must be made. But the banker will demand that the second year's interest must be earned. Furthermore, the earnings for the first 15 years must be sufficient by a safe margin to pay all interest charges and retire the securities which furnished the capital for construction. These earnings must be shown to be conservative by making allowance for maintenance, unforeseen expenses and accidents. If the proposition is such that these requirements can not be met, public financing is practically impossible.

There are pipe lines in operation which could not meet those requirements but they have all been financed privately, usually by large producers of natural gas. These corporations had large investments in gas properties lying idle through lack of markets and they could afford to defer the interest charges on pipe line securities for two or three years in order to receive an immediate revenue from the sale of natural gas to the pipe line. The interests of the builders of these lines are entirely different from those of a public buyer of pipe line securities and a public buyer should certainly beware of any gas transportation project in which initial earnings are unduly deferred.

Summary

In conclusion it might be well to summarize the main points discussed previously as they constitute the results of many years' participation in and observation of the natural gas industry and especially that branch of it which transports natural gas to consumers at great distances from the producing areas.

1. Natural gas is in many ways a superior fuel and under proper conditions a natural gas pipe line project affords a good investment medium.

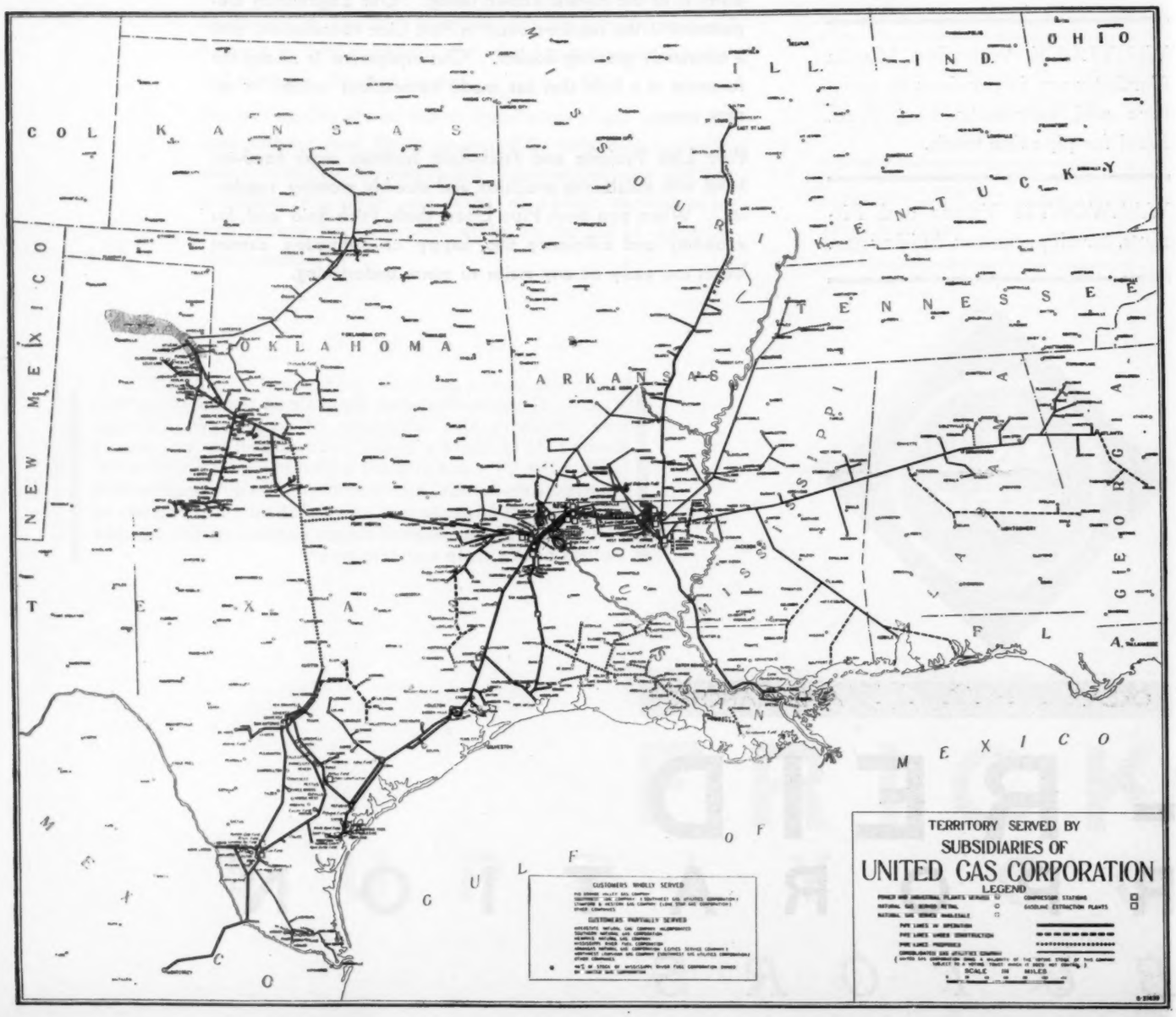
2. The proposed pipe line must control a supply of natural gas sufficient for its needs for a period in excess of the life of its senior securities.

3. It must have long-term market contracts covering the amount of gas it intends to transport.

4. The estimated earnings statement must show a return commensurate with the financial risk involved and must show sufficient revenue to begin returning the capital invested within two years and completing that return within 15 years.

5. The management personnel must be thoroughly experienced and entirely capable.

6. The financial resources of the company must be adequate to insure its survival during a period of local or general depression and its financial sponsorship must be of sufficiently high caliber to guarantee the success of any financing operations it may undertake.



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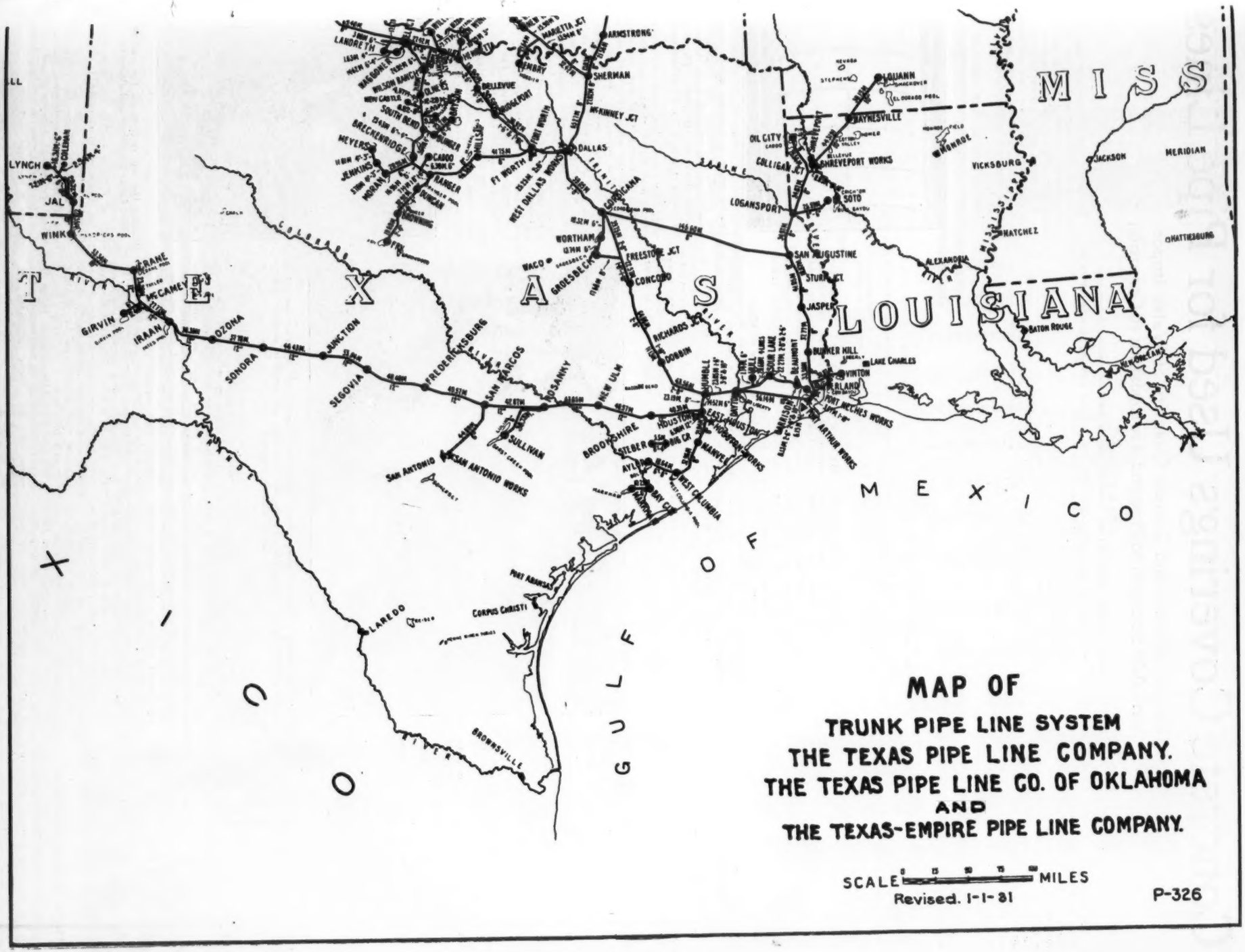

MAP OF

TRUNK PIPE LINE SYSTEM
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AND
THE TEXAS-EMPIRE PIPE LINE COMPANY.

SCALE 0 25 50 75 100 MILES

Revised. 1-1-31

P-326

Concrete Coverings Used for Pipe Lines

Proper Mixture and Correct Quantity of Water Important. Add Strength to Pipe and Are Resistant to Corrosion

By J. F. Hough
Assistant Manager, Structural and Technical Bureau, Portland Cement Association.

Portland cement mixtures, either in the form of mortar or concrete, have been used for many years as corrosive preventative coverings for pipe lines. As a general rule, concrete coverings have been considered relatively high in first cost, but subsequent freedom from maintenance and the absolute protection they afford have proved their ultimate economy.

Recent experiments in the laboratory of the Portland Cement Association have made available to pipe line operators a method of placing a thin layer of reinforced concrete around pipe of any diameter, which will provide protection for the life of the pipe line, and which at the same time will be economical in first cost.

The purpose of this article is to explain the progressive steps of the investigation and experiments that controlled the development of a concrete coating for the prevention of corrosion of steel pipe lines.

TABLE 1—MATERIALS REQUIRED FOR APPLYING 1-INCH CONCRETE ENCASEMENT PER MILE OF PIPE LINE

Size of pipe lines	Volume of concrete required per mile of pipe line cu. yd.	1 No. of squares (100 sq. ft.) required	1 Weight (lbs.) (15½ lb. per 100 sq. ft.)	2 Cement* (bbls.)	2 Water† (bbls.)	2 Sand (cu. yd.)	2 Gravel (cu. yd.)	3 Cement* (bbls.)	3 Water† (bbls.)	3 Sand (cu. yd.)	3 Gravel (cu. yd.)
4-inch..	23	112	2,070	40	18	9	17	46	21	9	16
6-inch..	33	140	2,590	55	25	12	24	64	29	13	21
8-inch..	41	168	3,100	70	31	16	31	81	36	16	27
10-inch..	50	196	3,625	85	38	19	38	98	44	20	33
12-inch..	59	235	4,350	99	45	22	44	115	52	23	39
16-inch..	73	280	5,180	123	56	27	55	142	64	28	48
20-inch..	90	336	6,220	152	69	34	68	175	79	35	59
22-inch..	99	364	6,740	166	75	37	74	192	87	39	65
24-inch..	107	397	7,350	181	82	40	80	209	95	42	70

*Four sacks cement per barrel. †Forty-two gallons water per barrel.
1—Two-inch by 6-inch, No. 13 by No. 13, mesh reinforcement required per mile of pipe line.
2—Mix, 1-1½-3; W/C, 4¾ gallons per sack of cement; slump, 0; gravel, one-fourth inch to three-eighths inch; yield, 5.992 cubic feet concrete per sack of cement.
3—Mix, 1-1.35-2.27; W/C, 4¾ gallons per sack of cement; slump, 2 to 3 inches; gravel one-fourth inch to three-eighths inch; yield, 3.452 cubic feet concrete per sack of cement.

Detail of forms used by Indiana Pipe Line Co. These are short sections used at bends or at joints.

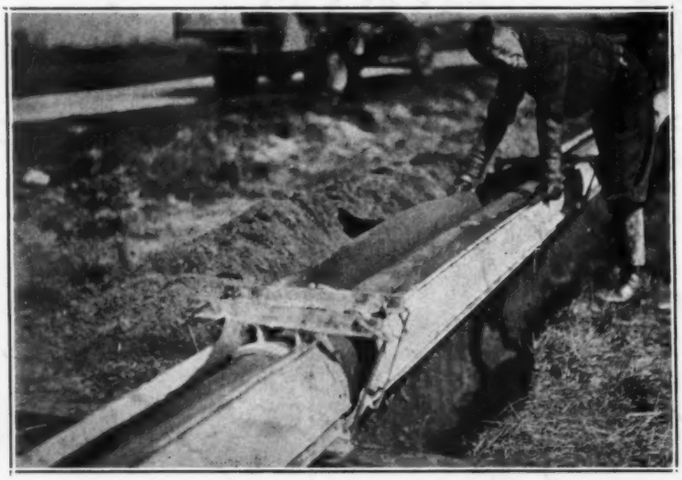
Inhibitor of Corrosion

Both by experiments and practical experience, concrete has proved its effectiveness as an inhibitor of corrosion. In the universal employment of concrete to protect steel from corrosion, every type and kind of soil and water has been encountered and protection afforded. No condition encountered in pipe line work exceeds in corrosive intensity known conditions where concrete has resisted corrosion and has given adequate protection to other materials it encased.

Aside from pipe lines, but nevertheless evidencing the effectiveness of real protection under the widest possible range of conditions, is found the protective value of concrete in the construction of foundations and caissons for buildings, bridges and dams; in shaft linings for mines; in tunnels through earth and water, and in sea walls. In every conceivable location and condition, concrete has resisted the elements in the earth and water that tend to destroy other materials in a relatively short period of time.

A careful study of the behavior of concrete under all types of corrosion conditions, some of which could not be improved upon readily as sites for accelerated tests, has determined the conditions necessary in the making of concrete that will provide protection in locations of severe exposure.

Placing the mortar in the forms.



Detail at joints occurring where pipe is supported over trench, showing method of opening forms to receive mortar. Forms are lined with tar paper to prevent leakage and facilitate removal.

Concrete is essentially a mass of fine and coarse aggregate particles separated yet bound together by a hardened cement paste. Some aggregate particles will permit practically no passage of water regardless of grading. Any water which passes through concrete must pass between the aggregate particles. If the intervening space is filled completely with cement paste, as it will be with proper workmanship, the liquid cannot percolate unless it passes through this paste.

The structure of a fresh cement paste is essentially a mass of solid cement particles with the intervening spaces filled with water. The greater the proportion of water to cement, the larger and more direct these openings or passages will be. The solid compounds formed during the hydration of cement tend to close these passages. The lower the water-cement ratio and the more favorable the conditions for retaining the mixing water in the mass until hydration is thoroughly established, the more completely closed will be these passages.

Limit Quantity of Water

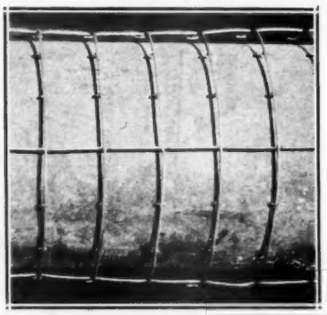
From these facts it can be understood readily why it is necessary to control, within definite limits, the proportional amount of water to cement entering the mix. Also, the use of sound and clean aggregates is essential. Tests and experience have shown conclusively that dense concrete made with not more than 5 gallons of water per sack of cement is watertight, strong and immune to attack by corrosive agents.

A distinction must be drawn between concrete and mortars. Concrete is a mixture of cement, water, sand and coarse particles of stone. Mortar involves only cement, water and sand, with no stone. Mortars, due to the excess fine material, require more mixing water than concretes to produce the same degree of workability and placeability when the same quantities of aggregates are used. Any increase in the amount of water used increases the porousness of hardened concrete, and decreases its strength, watertightness and effectiveness in resisting corrosive influences.

Mortars may have definite value as protective coverings in locations of mild-corrosivity, but where conditions are known to be severe concrete, not mortar, should be employed.

Frequently mortar coverings have been referred to by experimenters and others as concrete. Before a cement mixture can be correctly called concrete, it must contain a definite quantity of coarse aggregate particles larger than one-fourth inch in size. If these coarse particles are not contained in the mixture the material is mortar.

Before proceeding with laboratory experiments to devise an economical means of placing the required grade of concrete around pipe, an effort was made to determine the experience of pipe line operators in the use of concrete and mortar as protective coverings. Probably the oldest discovered was in Middletown, Conn. In 1866, 3 miles of 12-inch sheet iron water pipe were lined inside and coated outside with about one-half inch of mortar. This line, having become inadequate, was removed in 1930 and, after 64 years of constant service, was found to be perfectly preserved.



Reinforcement in position before forms are placed. Crimping the longitudinal wires at suitable intervals holds the mesh one-half inch off the pipe. The reinforcement is 2 by 6 No. 12 welded mesh.

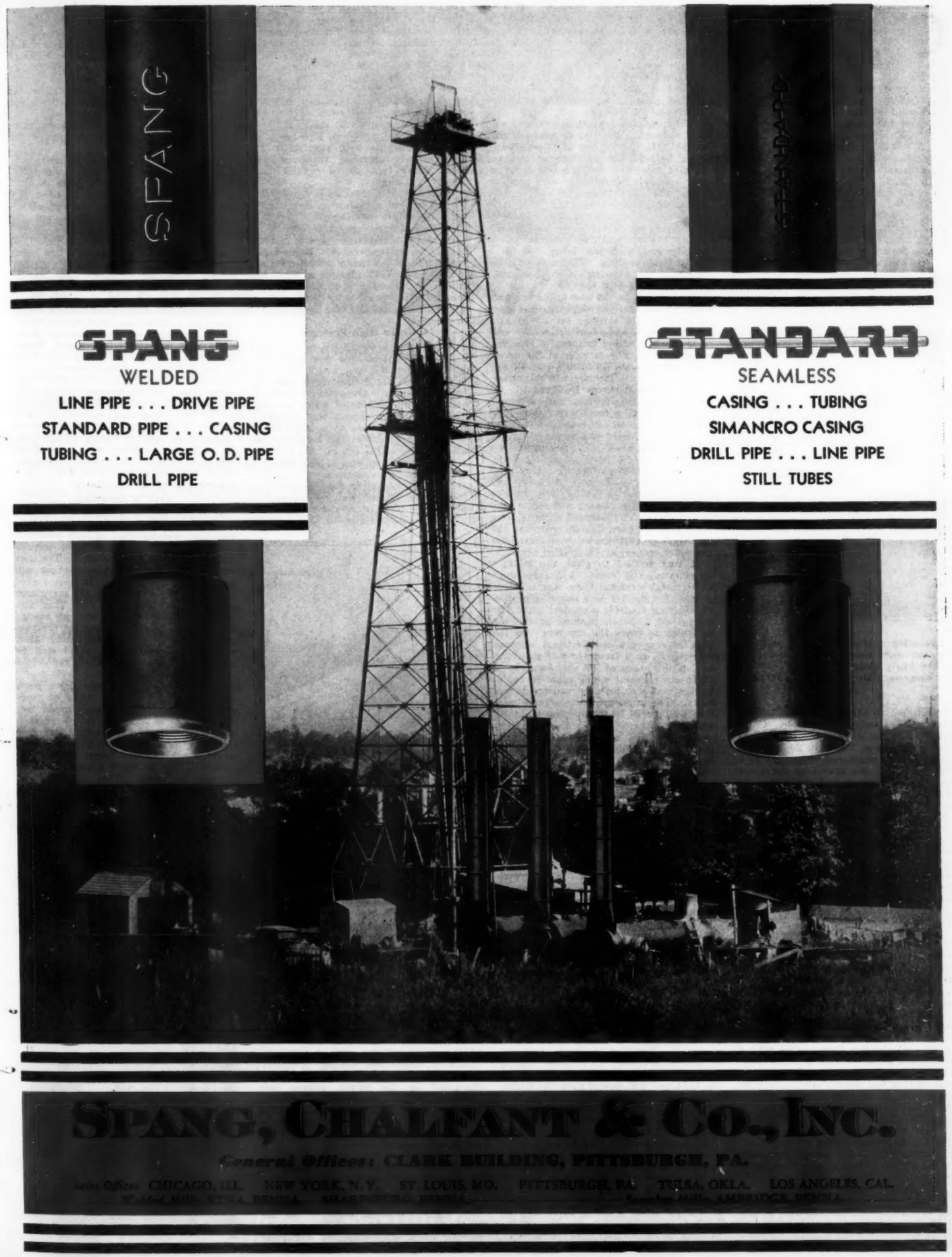
Examples of Practical Use

The following list indicates only a few cases where concrete and mortars have been used as pipe coverings in more recent years. In every case where concrete of definite quality has been employed, resistance to corrosion has been secured.

Pulling the top sections of the mortar filled forms into place and clamping.

The Temescal Water Co., Corona, Calif., in 1914, coated 8 miles of 10-inch to 30-inch pipe with 3 inches of concrete. After 16 years' service the pipe and coatings are in excellent condition.

Between 1913 and 1930, the Standard Pipe Line Co. coated 180 miles of 8-inch



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oil line with a 1-3 cement and coarse sand mortar. Located in Louisiana swamp land, this coating has given perfect protection.

To check serious disintegration of steel pipe by alkaline soils, the Dominguez Water Co., Los Angeles, Calif., has coated more than 8 miles of 8-inch to 30-inch water lines with 2 to 3 inches of reinforced mortar made in the proportions of one part cement to two parts sand. The first coating was applied in 1917. This covering has given perfect protection and has required no repairs or replacements for 13 years.

In 1926-7, the County Water District at Laguna Beach, Calif., coated 8 miles of 30"x$\frac{1}{4}$" steel plate pipe line with a thin coating of Gunite applied over light reinforcement. This covering is in excellent condition, and the pipe is free from any trace of corrosion.

In 1918, certain of the riveted steel pipe lines of the Sweetwater Water Co. in San Diego County, California, had

Illustrating bond of concrete to pipe. This was an unreinforced section but it required heavy sledges to break the 14-day old concrete with result shown in photograph.

deteriorated to such an extent that further repairs could not be made. Consequently, 6½ miles of their lines, varying in sizes from 2-inch to 24-inch were encased with reinforced concrete. A 1:2:3 mix, with pea gravel as the coarse aggregate was used, and the water content was held to a minimum. The thickness of the concrete covering varied from 2½ inches for the 6-inch pipe to 4 inches for the 24-inch. In 1926, when consideration was being given to the Laguna Beach line, noted above, an examination was made of the condition of the Sweetwater Water Co.'s concrete-encased lines, and their splendid condition was one of the determining factors in the selection of the protective covering of the Laguna Beach line.

In 1926, the East Bay Utility District of Oakland, Calif., adopted a three-quarter-inch Gunite covering as standard for both steel and cast iron lines of 12, 16, 20 and 30-inch sizes. On their main aqueduct line at three river crossings 4 inches of Gunite has been used for the protection of 56-inch pipe. Investigations were recently made of 30-inch pipe laid in 1930 in highly corrosive soil, where portions of the line were coated with a bituminous material and portions with three-quarter-inch Gunite. The bituminous coating had deteriorated to such an extent that the pipe was badly corroded, whereas the Gunite-covered pipe was in perfect condition.

At the present time, the Indiana Pipe Line Co. is reconditioning oil pipe lines by coating with a 1-3 cement and sand mortar, placed by means of a sheet metal form.

Cost of Cement Coatings

In studying the costs of the various uses of cement mixture coatings it was found that there was a wide variance, due principally to the amount of labor required in placing concrete and mortar by relatively crude methods. Wet or sloppy mixtures were needed when the concrete had to be placed in narrow spaces. Mortars were used fairly dry and, with the exception of Gunite, were usually applied by hand. Obviously it was necessary to devise a more rapid method of placing a concrete envelope around pipe to be practical from the standpoint of economy.

Three conditions must be complied with if a successful use is to be made of concrete: (1) the amount of mixing water must be held at 5 gallons or less per sack of cement if the concrete is to resist successfully sulphate and acid attack; (2) concrete containing as much aggregate as possible should be used in preference to mortar, in the interest of the quality required and the low cost desired; (3) the concrete must be placed quickly and with low labor cost in a fairly thin covering. The rate of application of the covering should keep pace with the balance of the job.

In addition to the above, the concrete should be reinforced, so as to resist more successfully the stresses set up in high pressure lines, and to withstand the natural rough handling incident to pipe line construction. The exterior of the covering preferably should have a smooth surface, to minimize the effect of soil stress.

Two Mixtures Designed

Two concrete mixtures were designed, each made with a total water content of 4¾ gallons per sack of cement. The first consisted of 1 part of cement, 1½ parts of well graded sand (0 to one-quarter-inch particles) and 3 parts of gravel (one-quarter to three-eighth-inch). This mixture had the appearance of being dry and unworkable, especially if it were to be placed in the ordinary manner in narrow forms. The second mixture was made slightly more fluid by reducing the aggregate proportions but by maintaining the water content at 4¾ gallons per sack.

It was decided to place the mixture by vibrating the forms. A No. 14 gauge sheet metal sectional form was made to provide for the 1¼-inch covering around an 8⅝-inch (outside diameter) pipe. The forms had a 4-inch opening at the top in which to place the concrete. In the first experiments an electrical vibrator was rigged on a frame to suit the form and rigidly secured to the form by a chain arrangement which could be rapidly tightened and loosened to provide mobility. The apparently unworkable mixture was placed in the opening provided, while the vibrator was in operation. The concrete settled and compacted around the pipe as rapidly as it could be placed in the opening. In subsequent experiments welded wire reinforcement 2-inch by 6-inch No. 12 gauge was placed around the pipe so as to be held in the center of the 1¼-inch covering. With the use of the vibrator the concrete compacted into place just as rapidly with reinforcement as when the wire mesh was not used.

Many coverings 1¼-inch thick, reinforced and unreinforced, were experimented with. In the study of mixtures it was found that the 1:1½:3 with 4¾ gallons of water per sack of cement was the most suitable, both from the quality standpoint and the yield. A slightly modified mix, 1:1.35:2.27, used with the same amount of mixing water, has slightly more workability, but is not as economical due to the additional cement required.

Thickness of Covering

As the result of these experiments, a covering of at least 1 inch is recommended for pipe of 12 inches or less in diameter. For pipe of larger diameter, it may be necessary to increase slightly the thickness of the covering. However, the thickness will depend upon the limitations of placing. A 1-inch covering may suffice for pipe up to 20 inches in diameter, provided the type of vibrator used will compact the concrete into place without causing honeycombing or segregation. The reinforcement must be held rigidly in place in the center of the covering so as to have full protection of at least one-half inch of concrete. When an analysis is made of the cost of a covering it will be found that the extra cost of one-half inch additional concrete will be so little as to be negligible, in view of the extra protection afforded and the greater ease with which it may be placed.

In the experiments being described no effort was made to perfect the forms and the vibrator attachments. It is obvious that the forms may be simplified or modified to suit field conditions. The vibrators used were part of the regular laboratory equipment with a simple attachment added to fit the form. Vibrator manufacturers will develop any type of base or attachment to fit the form finally adopted for a particular pipe line. In these experiments both electrically and pneumatically operated vibrators were used. Each type placed equally satisfactory coverings.

Concrete bonds thoroughly to the pipe. Due to natural shrinkage during hardening, the concrete covering adheres tightly. High internal pressure, especially in gas lines, causes unrestrained pipe to increase slightly in circumference. Experiments were made to determine the effectiveness of the restraining influence of plain and reinforced concrete coverings. In the same experiments the value of a "cushion" between the pipe and the concrete was determined.

Under High Pressure

A 10-foot length of 8⅝-inch outside diameter 25-pound pipe having a wall thickness of 0.277 inch was divided into four sections and each covered with 1¼ inches of concrete proportioned 1:1½:3, made with 4¾ gallons of water per sack of cement. Each section was separated from adjacent sections by a metal collar in order that under test it would act independently of the others. On two sections the concrete was applied directly to the pipe. Two sections were applied over a thin asphaltic emulsion coating. One section of each was reinforced and one left plain. The reinforced was No. 12 welded mesh, 2-inch by 6-inch, with

Completed cement-mortar coated 8-inch oil line ready for lowering.

the 2-inch spacing running circumferentially. The concrete was placed with the use of a vibrator. The forms were removed within 24 hours, and the concrete kept moist under damp burlap for 14 days.

The pipe was then filled with water and attached to a high pressure drum of nitrogen. Pressures up to 1,000 pounds per square inch, built up in 100-pound increments, were repeatedly applied to the liquid within the pipe. Strain-gauge measurements were taken continually to record all changes in diameter of the pipe and covering. At some point between 900 and 1,000 pounds per square inch a longitudinal hair line crack developed in the unreinforced section that was applied directly to the pipe. None of the other sections was in any way fractured under the applied pressures. The maximum increase in diameter as measured by the strain gauges was 0.00011 inch on one of the unreinforced sections. The reinforced section over the asphalt emulsion showed an increase in diameter of 0.00005 inch at 1,000 pounds per square inch pressure.

Concrete Withstood Strain

There was no registered increase in diameter of the reinforced sections applied directly on the pipe. This demonstrated clearly the value of the reinforcement. Also, there was some value to the asphalt emulsion cushion as the concrete did not crack even though a negligible increase in diameter was registered.

In other experiments involving internal pressures one-fourth-inch holes were cut in several places in the steel pipe before the concrete covering was applied. After the concrete had hardened for 14 days, internal pressures up to 900 pounds per square inch were built up as described previously. The covering did not crack or show any signs of distress, and the bond of the covering was such, that colored liquid in the pipe did not migrate between the covering and the pipe in the vicinity of the holes.

A test to determine the density and liquidtightness of the covering was made. A specimen of 1:1½:3 concrete was cut from an applied 1¼-inch covering and placed in the laboratory impermeability apparatus. Water at 200 pounds per square inch pressure was applied to the concrete continuously for 10 days and no liquid was forced through this specimen.

Similar specimens were submitted to freezing and thawing and sodium sulphate tests, and after more than 100 cycles not the slightest effect was noted on the concrete. These are particularly severe tests, and only concrete of extreme denseness and impermeability would remain unaffected through this number of cycles.

Parallel test specimens tested in compression showed strengths of over 3,000 pounds per square inch at 7 days, 4,200 pounds at 14 days, and over 5,000 pounds at 28 days. This great strength is transmitted to the pipe line and leads to the thought that pipe of lighter weight could be used when protected with a 1-inch reinforced concrete covering. This possibility has not been studied, but it is a matter worthy of investigation.

Cost of Coverings

A study of the amounts of material required for a 1-inch concrete covering indicates that the cost of such coverings will depend largely upon labor, experience, and the equipment used. The item of forms and their transportation will be of first importance. In this regard much can be learned from the experience of the Indiana Pipe Line Co. This company has been applying cement mortar coverings to 8-inch oil lines for the past several years. The forms being used, with slight modification, could well be adapted to the methods of applying concrete described herein.

Forms sufficient for one day's work are provided. They are made of sheet metal reinforced with small angle sections. If it is contemplated to place 1 mile of covering in a working day this length of forms will be required. With vibrated concrete the forms may be removed in six or eight hours after the concrete is placed. They may then be moved forward and assembled for the next day's work. Sectional metal forms, either hinged or clamped, would nest one within the other, and many hundreds of lineal feet of forms could be loaded on one truck.

With the mortar being used by the Indiana Pipe Line Co. vibration is not necessary for proper placing. In places of known or severe corrosivity where it would be necessary to use a dense concrete to give adequate protection, the sheet metal forms will require more substantial construction at the openings to withstand the action of vibrators. Aside from vibration, the method used for plac-

Wet going on gas line in Georgia.

LEX again leads

DESIGN AND APPLICATION

TION—Byron Jackson engineers have made a y of pipe line applications with the very gratifying

Speed—It is common knowledge that centrifugal cover a wide range of operation without throttling, eed may be varied, and still maintain good efficiency. ethod of operation Byron Jackson first introduced e service, high speed centrifugal pumps driven by bustion engines through step-up gears, which is an d of speed variation.

Speed—With electric motor drive it was desirable ne means of realizing the same flexibility of control ht speed, as was accomplished with variable speed a proper combination of pumping units in one or s, a new method of operation at constant speed has ically evolved, which permits of this flexibility. The a may be separated into divisions consisting of two ons, in each of which are located two or more pumps, s of which will give the desired variation of control. of this is illustrated on the chart which shows a divi- ed of two pipe line stations. Seven different capac- ssures, from 10,000 to 30,000 barrels, can be ob- not more than two pumps running in each station, hrottling. By a new method of layout tedious compu- eliminated, and a proper selection of pumps for a may be easily made by means of a series of graphs.

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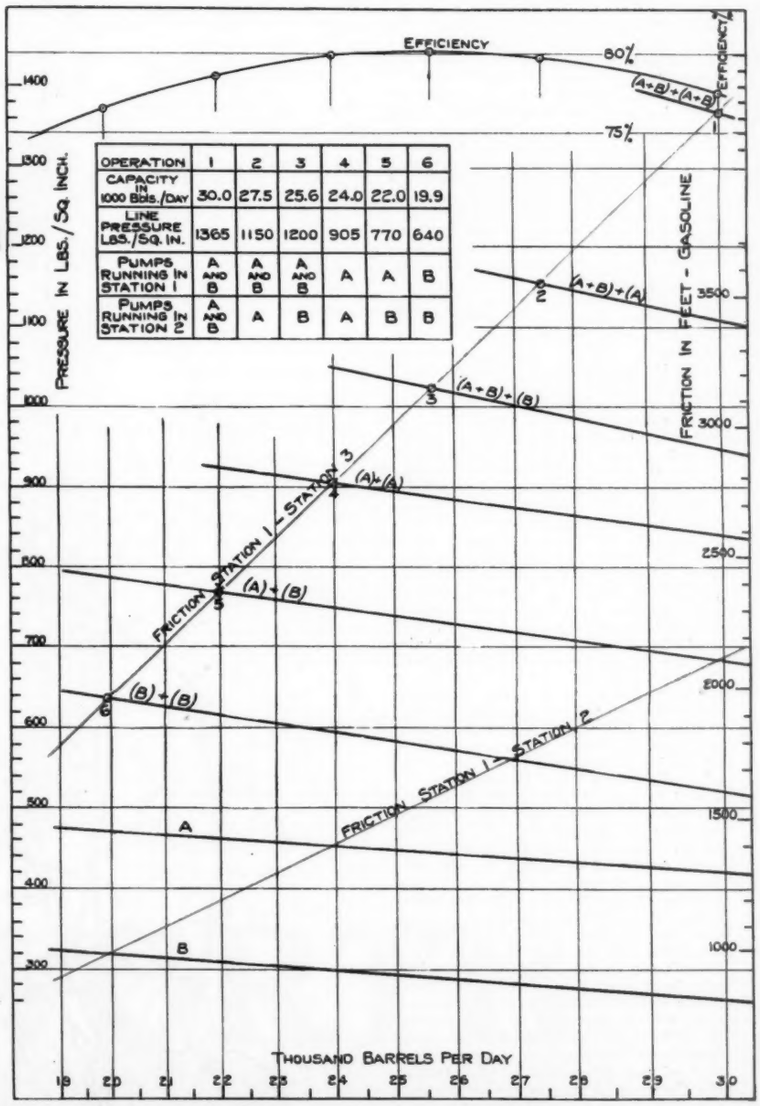

OPERATION	1	2	3	4	5	6
CAPACITY IN 1000 BBLS./DAY	30.0	27.5	25.6	24.0	22.0	19.9
LINE PRESSURE LBS./SQ. IN.	1365	1150	1200	905	770	640
PUMPS RUNNING IN STATION 1	A AND B	A AND B	A AND B	A	A	B
PUMPS RUNNING IN STATION 2	A AND B	A	B	A	B	B

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ing mortar coverings differ but little from the method of placing concrete.

Practically all equipment, other than forms that would be required, could be mounted on one truck or trailer. A concrete mixer with a hopper for the mixed concrete would be advisable. If an electric vibrator is used the generator and auxiliary motor could be located on the same truck. If pneumatic vibration is employed, the generator would be replaced with a compressor.

The aggregate could be hauled in a double-bodied truck, or the fine and coarse material could be precombined at a central plant and hauled to the site in measured proportions in batch boxes.

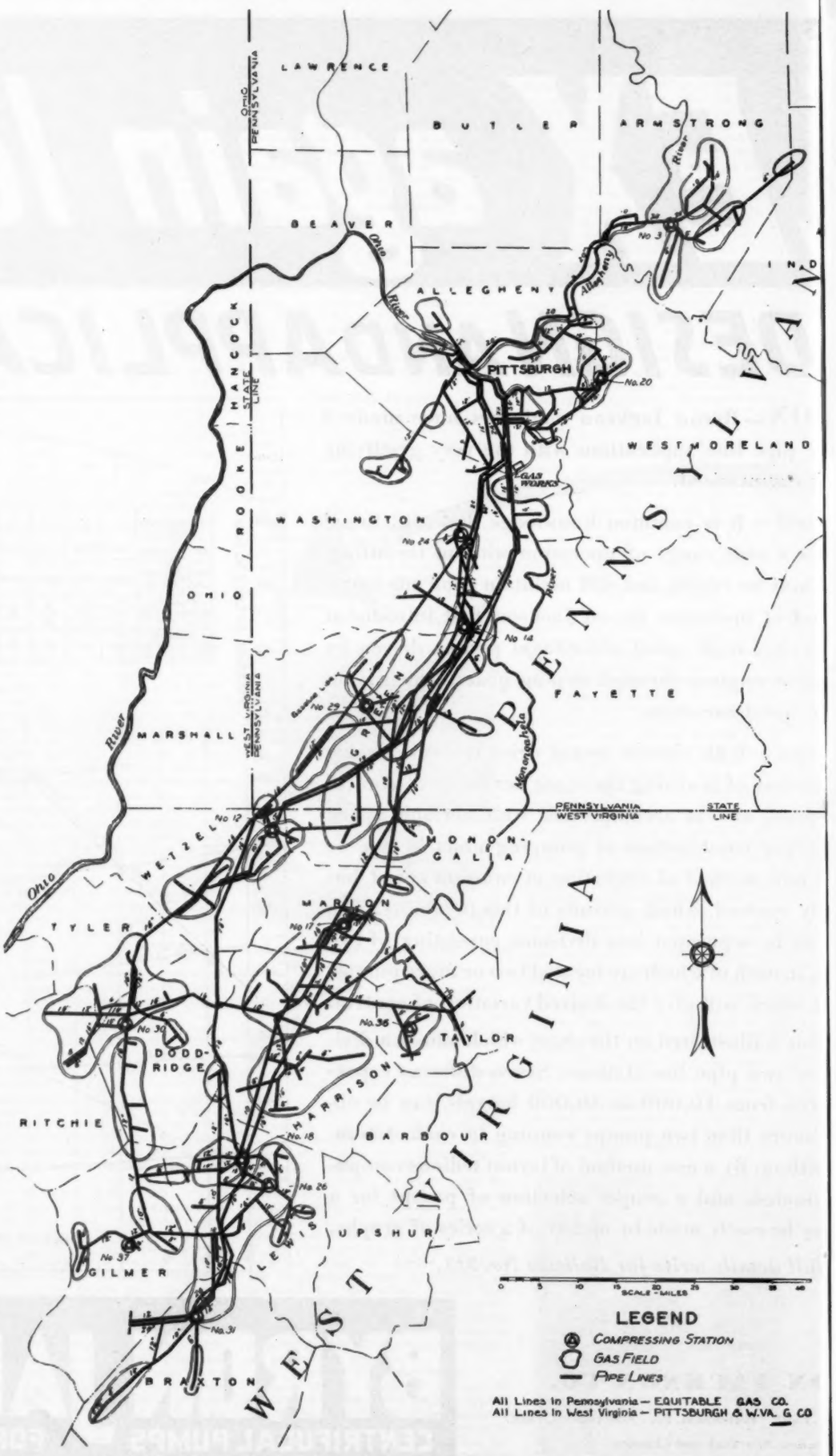
Pneumatic Conveyors

In favorable locations the mixing equipment can follow along the trench and the concrete chuted directly into the forms from the mixer or hopper. Another method, but one requiring another piece of equipment, would be the use of a pneumatic conveying device similar to that used in tunnel construction. With such equipment the mixing unit could be located a long distance away from the pipe line and the mixed concrete conveyed through flexible hose or pipe to the place of deposit. Such equipment is not excessive in cost and on large jobs would probably prove economical.

The only other piece of equipment needed other than those required in any ordinary pipe line work would be a water tank of ample capacity.

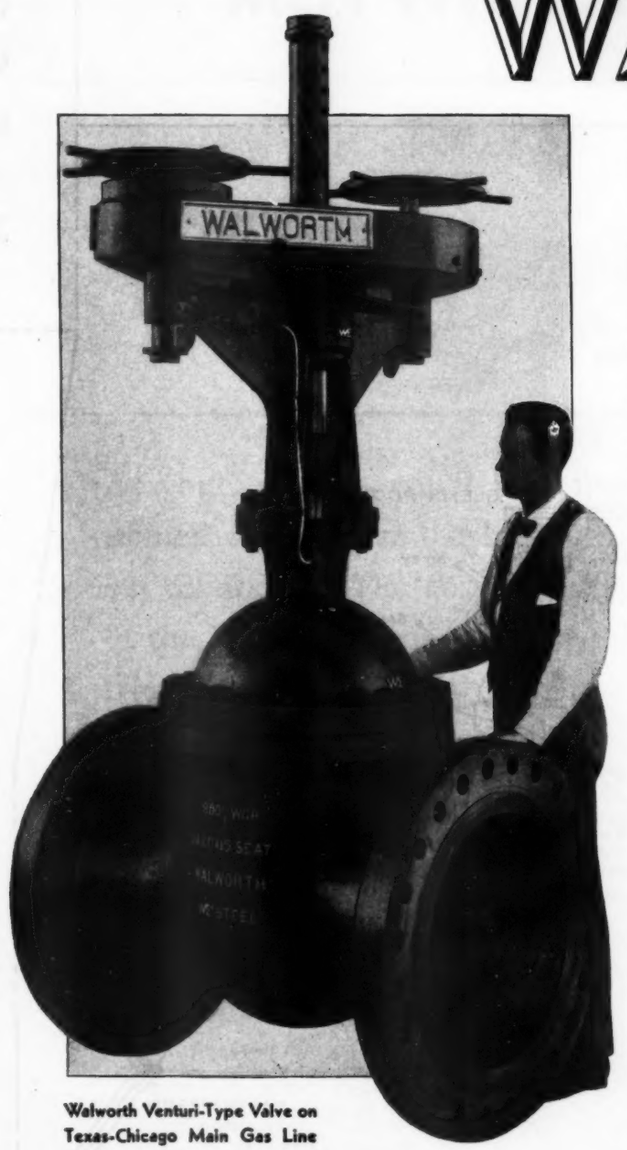
An instimate of the cost of a concrete covering would necessarily be affected by the availability and cost of materials and the topography of the terrain. Based on the experiences of the Indiana Pipe Line Co. and general engineering practice, it is estimated that under favorable conditions of operation and availability of materials, a 1-inch concrete covering as described herein would cost between 2 and 3 cents per inch diameter per foot of length. Swampy land or other unfavorable conditions would necessarily increase the cost.

The principal advantages of a concrete covering may be summed up as follows: (1) The effectiveness of concrete in providing protection against corrosion is definitely known from experiments over 10 years in the most unfavorable and severe alkaline location known to exist. As the quality of the concrete is governed by the water-cement ratio, concrete which will resist any known condition of corrosivity can be made by controlling the amount of water entering the mix. As more knowledge of the corrosivity of different locations is gained, and as devices are perfected for predetermining the degree of corrosion of any soil, the quality of the concrete may be accurately varied to suit the conditions to be encountered. Where absolute protection is desired, the approximate mixtures, water-cement ratio, and methods of placing as described herein should be adhered to until better knowledge of the actual corrosivity of any soil is known. (2) Concrete coverings are more economical than mortar coverings for mixtures of the same water-cement ratio and the same degree of placeability. (3) Soil stresses which produce distortion or disruption of plastic or semiplastic materials will not affect a concrete covering. Concrete coverings are not subject to disruption due to backfill in locations of rock cut or unusually deep trenches. (4) Great strength is added to the pipe. Minor weld failures or interior corrosion spots will be protected by the concrete. (5) The additional weight of concrete coverings is sufficient to prevent "floating" of gas pipes out of the trench. (6) Creeping of pipe in the trench will not disrupt the concrete covering. The coefficients of expansion of concrete and steel are essentially the same, and the bond between the concrete and the pipe will not be broken due to the differences in expansion. In the numerous examples cited herein where concrete or cement mixture coatings have been used, no trouble has been encountered from this cause. Concrete covered pipes may be lowered into trenches with ordinary care without cracking the coating. (7) A concrete covering of necessary quality can be placed as quickly as, and in nearly all cases much faster than, any other type of applied coating.



Map of Transportation System of the Equitable Gas Company and Affiliated Companies.

WALWORTH SIGMA STEEL VALVES



Walworth Venturi-Type Valve on Texas-Chicago Main Gas Line

The latest in Pipe Line Valves

This illustration shows the main line valve selected by The Continental Construction Corporation for The Natural Gas Company of America's 960-mile, 24" O. D., 800-pound G.W.P. line from Texas to Chicago.

Outstanding features of this valve are:—

1. Venturi construction—port diameter at the seat being equivalent to a 16" valve.
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4. Telescoping brass tubing to prevent dirt working into the stuffing box when the valve is buried.
5. Glass lined stem cover to permit operator to judge position of disc.

We feel that we have due cause to be proud of the Walworth engineers who designed these valves and of the foundry men and machinists by whose unsurpassed workmanship they were built.

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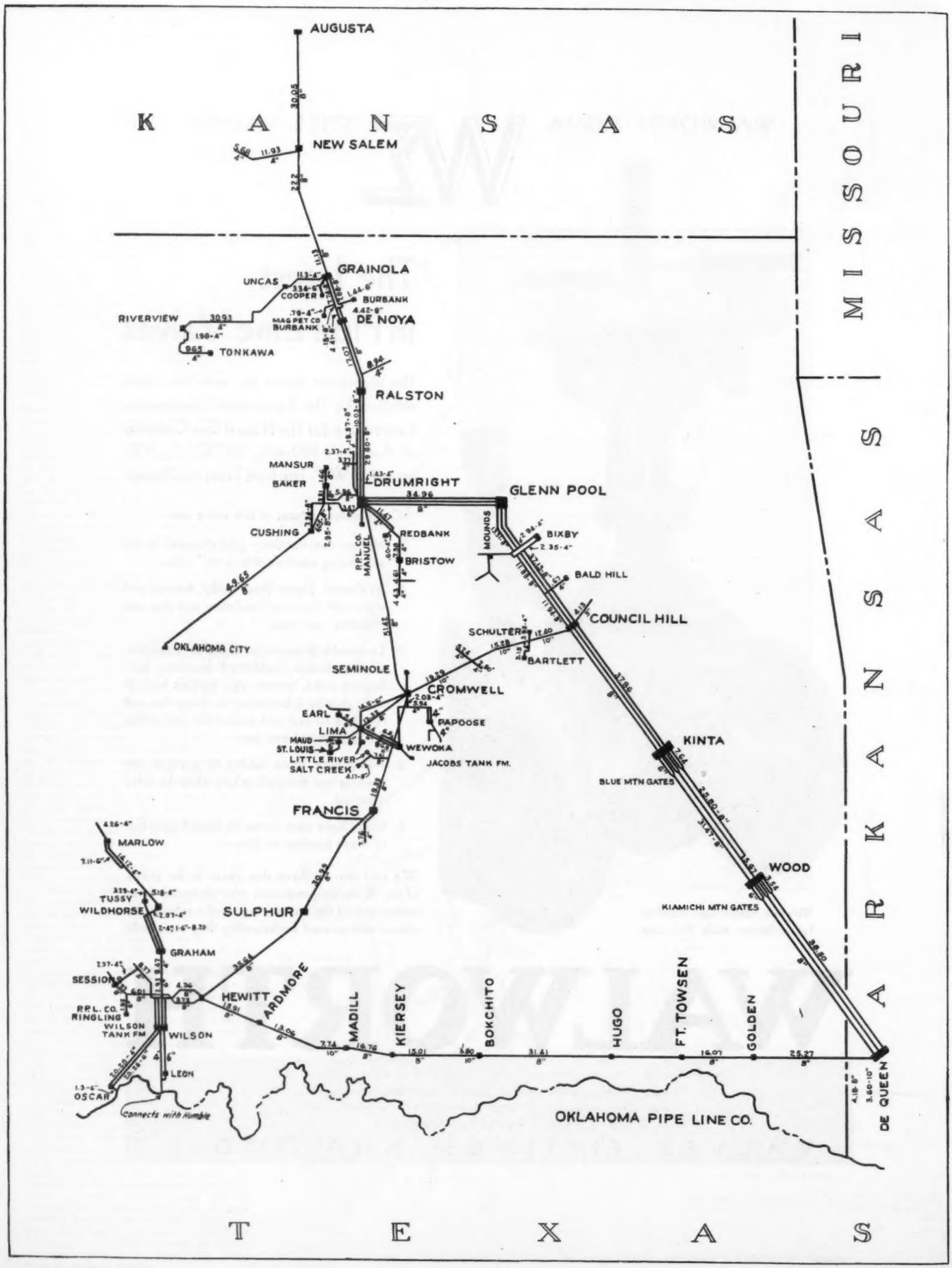
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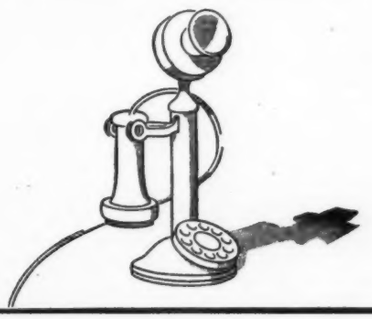

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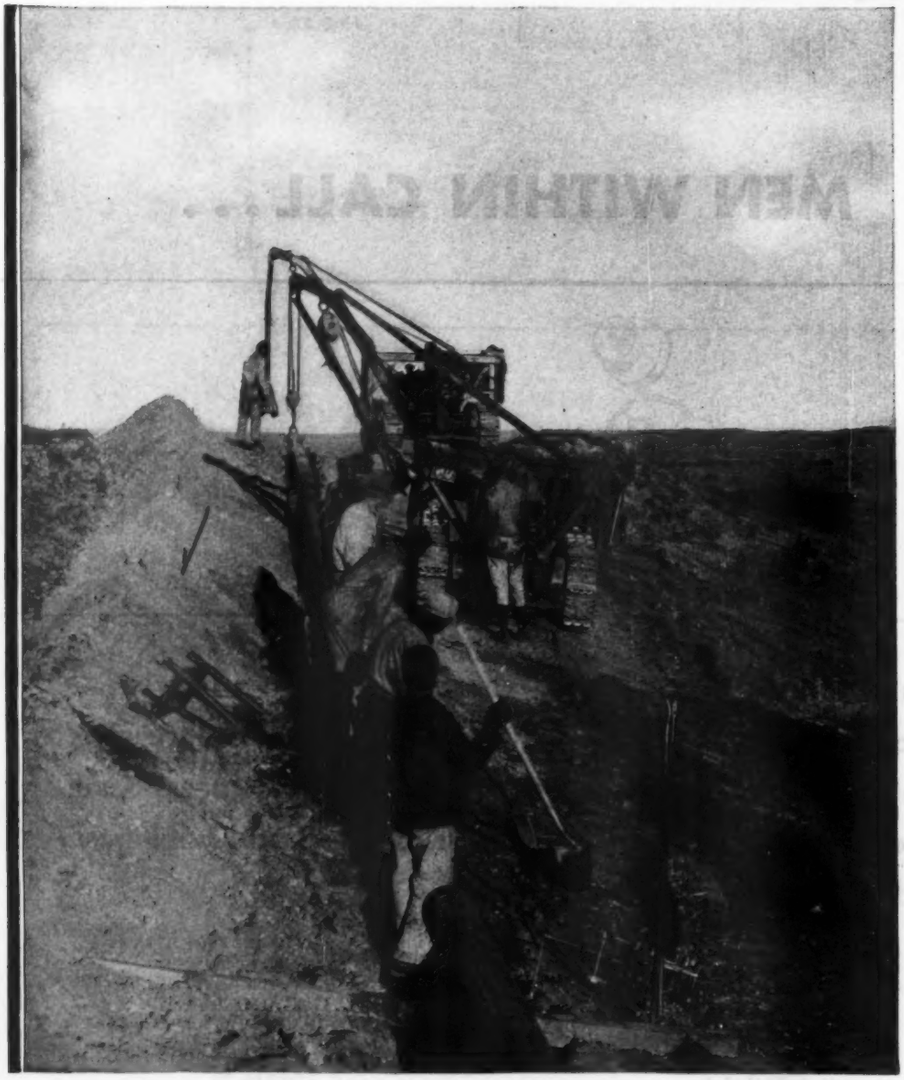

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New Development in Acetylene Welding

Lindeweld Process Permits Far Greater Speed. Welds Show Strength Fully as Great as Pipe Itself

By G. O. Carter
Consulting Engineer, Linde Air Products Co.

The unprecedented activity in the construction of long overland pipe lines for oil and gas transmission has been marked by an ever-increasing use of oxy-acetylene welding for making the pipe joints. A survey completed not long ago indicated that of all overland lines laid during 1930 over 70 per cent were oxy-acetylene welded. The combined mileage of the oxwelded twin 10-inch Ajax pipe line, the Great Lakes system, the Phillips pipe lines and the Missouri-Kansas pipe line was greater than the mileage joined by all other methods.

A sound basis for this confidence in oxy-acetylene welding was found in the construction and operating records of the thousands of miles of oxwelded oil and gas lines that had already been laid under procedure control. The permanent tightness of the oxy-acetylene welded joint has made it possible to transport millions of barrels of oil without the loss of a single barrel. In the natural gas field, a review of published statistics on leakage reveals the success of welding in reducing leakage to a negligible figure. Leakage as low as 10,000 cubic feet per year per mile per 3-inch equivalent has been accepted as standard, an undreamed-of figure prior to the advent of welding. The only opportunity for leakage on a welded gas line occurs in the flanged connections which are necessary for valves and other attachments.

Many companies have entirely eliminated line walking crews on welded lines, and at the same time are able to reduce their claim department and emergency repair crews to a minimum.

Welding has effected a further economy in the matter of applying a protective coating to the line as a welded line has a smooth surface finish.

Improved Welding Rod

The transportation of natural gas over great distances with economy has necessitated the use of extremely high pressures, which, in turn, has required special high strength pipe. Large diameter pipe is being used at the present time which has a carbon content of 0.30 to 0.40 per cent and an ultimate strength between 80,000 and 100,000 pounds per square inch. It is interesting to note that with the use of higher strength material for the pipe has come the development of welding rod suitable for making satisfactory welds in these materials. By the use of high quality welding rod of the correct types, in accordance with procedure control, welds are regularly obtained in high strength pipe which consistently develop the full strength of the pipe. Results of research investigations of the structure of welds made with various types of welding rod, and the current practice of making tensile and bend tests in the field, have impressed users of welding with the vital bearing that welding rod has upon the character of the finished weld. The strength of welds is carefully studied today, and it is well known that the tensile strength is directly proportional to the quality of the rod, other factors being equal.

The success of oxy-acetylene welding in the natural gas field has been paralleled in the construction of long overland pipe lines for the transmission of gasoline. Three large projects of this type have been under construction during the past year, the Sun pipe line, running from Philadelphia to Pittsburgh, Cleveland and other cities in Ohio, the Phillips Petroleum Co.'s line from Texas to Kansas City and St. Louis, and the Great Lakes pipe line, a 1,300-mile line from Oklahoma refineries to Chicago and the Great Lakes region. All of these lines are oxy-acetylene welded. The Great Lakes pipe line consists of 6 and 8-inch seamless pipe, welded with high test welding rod, and carefully tested to 1,000 pounds per square inch pressure. A station pressure of about 800 pounds per square inch will be used during operation.

The Lindewelder Blowpipe makes the process semiautomatic.

Tack weld is made on 20-inch pipe.

The Lindeweld Process

A great achievement in pipe line welding of recent years has been the introduction of the Lindeweld process. Lindewelding, a fast and economical process for oxy-acetylene pipe welding, was developed in the Union Carbide & Carbon Research Laboratories, and was subsequently introduced by our company to pipe line companies in various parts of the country. Most of the first installations by the new process were comparatively short, ranging in length from 1 mile up to 50 miles, as the pipe line companies wished to try out this method experimentally before adopting it for all of their work. In these tests, practically all standard grades of pipe made by different manufacturers were used and nearly all pipe sizes ranging from 4-inch to 24-inch were welded. The joints in all of these installations have been subjected to the most rigid tests which have shown that joints are equal in strength to the pipe. The economies which have resulted from the use of the process have led many pipe line companies to adopt the Lindeweld process for all future construction as rapidly as operators can be trained or as soon as the contractors are familiarized with the correct procedure so that bids can reflect the economy available.

The Lindeweld process is best described as a method of oxy-acetylene welding in which the weld metal is caused to be fused with the base metal through the medium of a low melting point, high carbon iron alloy. The method consists essentially of: (a) Preparing the base metal for fusion by a properly adjusted welding flame; (b) the use of a technique or manipulation of flame and rod somewhat different from the usual method of welding; (c) the use of a special welding rod, known as Oxweld No. 24.

Economies Effected

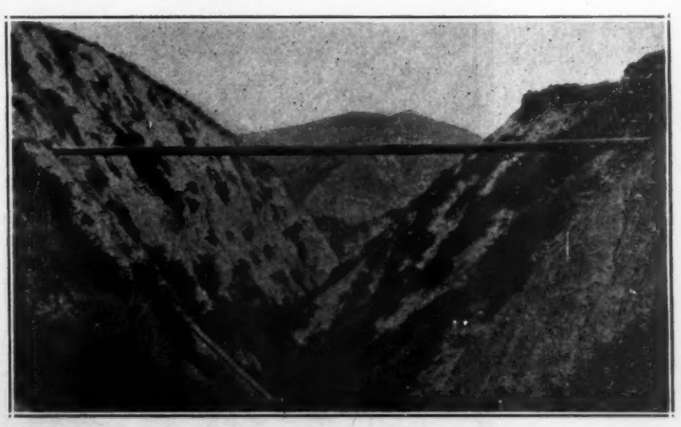
Since very little breakdown or melting of the base metal is required with the correct procedure and as a much smaller spacing can be used, a decided economy is effected in the amount of welding rod, gases and time required for welding.

Although the Lindeweld process differs in technique and manipulation from oxwelding, experienced welders find no difficulty in adapting themselves to the new method. It is also more readily learned by student welders than the former method.

Standard plain end pipe with the ends beveled to give an included angle of from 70° to 90° is recommended for the Lindeweld process, greater speed and economy being obtained with the smaller bevel.

Miter bend at approach crossing.

The welds may be made either with or without the Linde liner, the liner being recommended especially for the larger sizes of pipe. These liners are of thin material, about one-sixteenth to three-thirty-seconds of an inch thick, depending upon the pipe diameter, and from 1¼ to 1½ inches wide, and fit inside of the pipe joint under the butt weld.



More than 100 feet of Lindewelded 16-inch pipe left suspended in canyon crossing.

OXY-ACETYLENE . . . *Predominates*

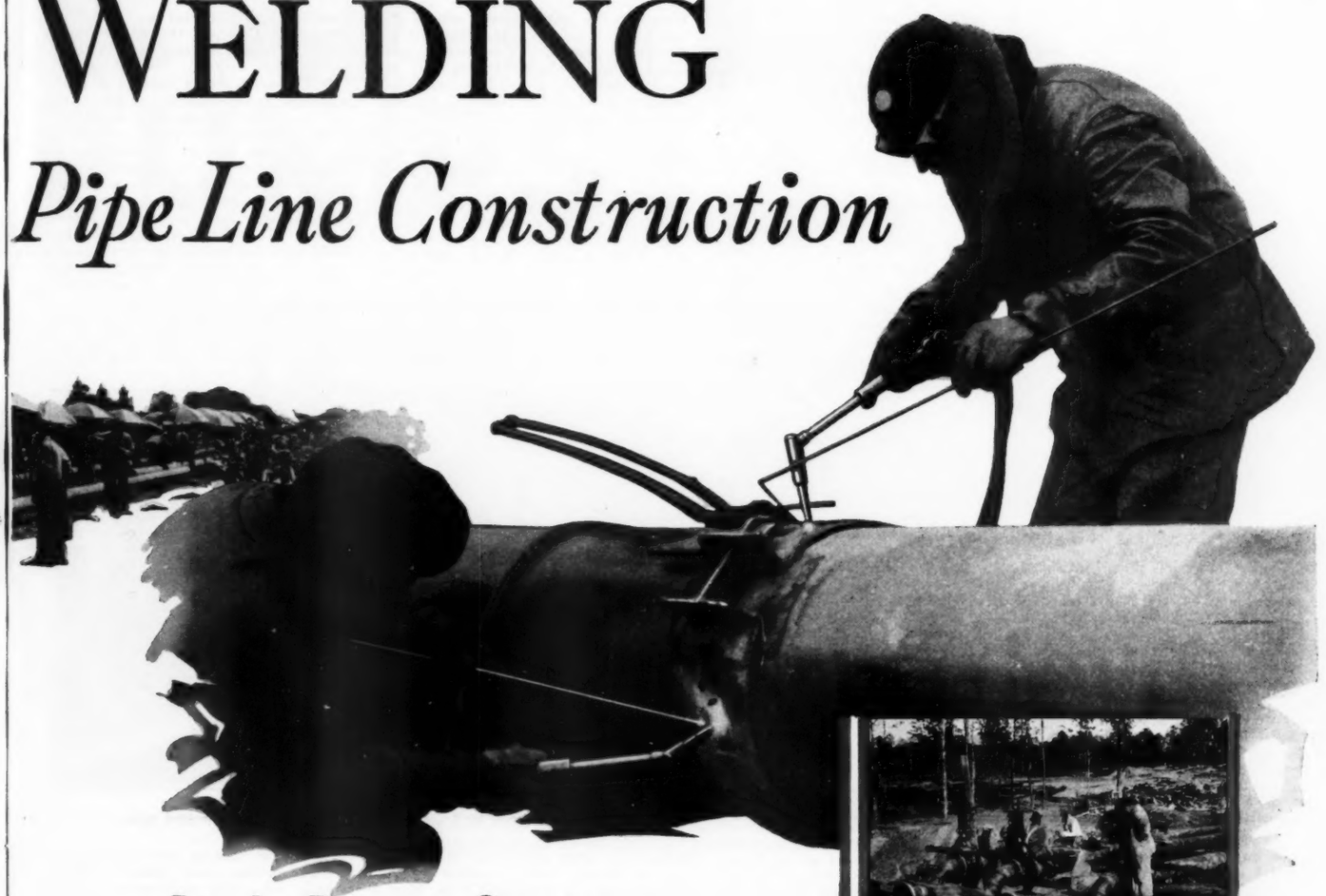
Oxy-acetylene welding a 20-in. natural gas line.

River crossing of 8 in. extra heavy pipe oxy-acetylene welded.

MORE miles of trunk pipe lines were oxy-acetylene welded during 1930 than in any previous year. More miles were gas welded than were joined by all other means combined.

In every climate, under every topographical condition, oxy-acetylene welding has proved to be the most reliable method of joining pipe lines. Oxy-acetylene welded lines are laid with confidence across rivers, over mountains, prairies, deserts, hill country and marsh land. Oxwelded lines are permanently tight and universally satisfactory from the standpoints of installation and maintenance costs and operating efficiency Transportation of oil, gas and gasoline through these lines continues year after year without interruption.

WELDING
Pipe Line Construction



Linde Process Service assures dependable pipe welds

Linde Process Service, applied in laying thousands of miles of pipe every year, has pioneered many advances in welding for maximum speed, economy and dependability. Step by step from mobilizing, training and testing of welders this service follows through to the final testing of the completed line.

It effectively supplements the work of your own engineers. It translates proved methods and well established laboratory findings into terms of actual field operation.

If you are a user of Linde Oxygen you are privileged to call upon Linde Process Service for assistance or advice. Write or telephone the nearest Linde District Office.

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This liner has spacers attached to it which accurately govern the spacing and its use permits complete fusion to the full thickness of the pipe wall. In fact, it is possible to reinforce the inside of the joint by fusing through to the liner and making it an integral part of the weld. Any possibility of protrusions or icicles on the inside of the pipe is, therefore, eliminated and yet the reinforcement is carried through to the inside of the pipe wall so that a full strength joint is obtained even without external reinforcement which is often fallaciously assumed to compensate for a possible weakness at the bottom of the vee. The liner fits so snugly inside of the pipe wall that there is little, if any, obstruction presented to the flow of the liquid or gas.

Test Made in Panhandle

An interesting field test of Lindewelding was made by a pipe line company on a 1-mile section of a gas line in the Texas Panhandle. The pipe was 24-inch (outside diameter) 0.25 to 0.35 per cent carbon seamless pipe, having a strength of from 70,000 to 80,000 pounds per square inch. Linde liners were used in making all the welds.

Seven welders were given one day's training in the Lindeweld process, after which they were required to pass a qualification test. This 1 mile of pipe was welded for purely experimental purposes and a great many welds were cut out and tested. A weld, selected at random from each day's production of each welder, was tested in order to determine the uniformity of the work.

The pipe line construction company made its check on the Lindeweld process by welding 2,000 feet of pipe solidly and laying it in slack wallops in and out of a 64-inch trench, that is, the pipe was bent so as to come out of the trench over 8-inch cross skids placed across the top of the trench and back again to the bottom of the ditch with a distance between wallops ranging between 300 and 400 feet.

While the pipe was subjected to these bending strains, the line was allowed to expand and contract with changing temperature, which imposed additional high stresses on both the pipe and joints. The test specimens were cut out after this test had been completed. In all, 336 welds were cut out and 216 tensile coupons were tested. They showed an average tensile strength of 74,500 pounds per square inch. A total of 144 bend coupons were tested, with an average of 92° angular bend when the outside of the weld was in tension and 61° angular bend when the inside of the weld was in tension.

Line in California

The Southern Counties Gas Co. recently completed a 16-inch natural gas transmission line from Ventura to Santa Barbara, Calif., a distance of 35 miles. After very severe tests had been made by the gas company it was decided that this work would be done by the Lindeweld process. The gas company requested the contractors to use it and to revise their bids in order to take advantage of the economies which would result from its use. The revised bids of the contractors reflected the savings which this method made possible.

The actual construction of this 35-mile pipe line presented certain problems owing to the nature of the terrain, but the whole project was handled with great efficiency and a minimum of trouble. The southern half from Ventura north was built by the Lang Construction Co. and the northern part to Santa Barbara by the Southern California Construction Co. This latter portion included about 3 miles of extremely rocky country, a section through the residential district of Montecito, and a considerable stretch along the public highway which necessitated several underground crossings without interruption to traffic. The ditch work in the rocky section naturally slowed down construction operations as dynamiting had to be done and many of the bell holes themselves had to be blasted in solid rock.

The 16-inch pipe was furnished in 40-foot lengths. On the job, sections from 100 to 300 feet were welded together by the Lindeweld process before the pipe was lowered into the ditch for the tie-in welds. Dollies were used for making all the rolling welds in assembling these sections. The length of these sections could not be standardized throughout the length of the pipe line, as the changes in direction were so numerous. The final tie-in welds were generally made in the early morning or after backfilling so that the lowest temperature would be experienced, reducing contraction stresses to a minmum.

Making Tie-in Welds

One of the most interesting features of this project occurred in connection with the tie-in welds. In most of the Lindewelded pipe lines constructed up to that time, it had been customary to make the rolling welds by the Lindeweld process and to make the tie-ins or stationary welds by the ripple weld process using high test welding rod. This was the original intention on this pipe line, and the first part of the line was joined in this way. The Southern California Construction Co. found that their tie-in welders could make welds in position by a modification of the Lindeweld technique with ease and much greater speed. Since local conditions permitted, the procedure was changed, and Lindeweld process welding rod was used to make all the welds, both rolling and tie-in, on the last 15 miles of the line, and was used to weld solidly an additional 3 miles of 14-inch pipe as an extension to this line.

The pipe used on this line was furnished by the manufacturer with a narrow bevel, which is best suited for the Lindeweld process, and resulted in economies in welding rod. Liners were not used on any part of this line, as the gas company decided they would be unnecessary for this size pipe. On larger diameter pipe, the use of a liner is recommended for the Lindeweld process.

At one point the pipe line had to be laid on a steep hillside. This hill was 1,100 feet high and had a grade of between 50 to 60 per cent. It was so rough and steep that rolling welds were out of the question. Double and triple lengths were welded together at the top of the hill, let down and joined by stationary welds. All of the welds on this hill were made by the Lindeweld process.

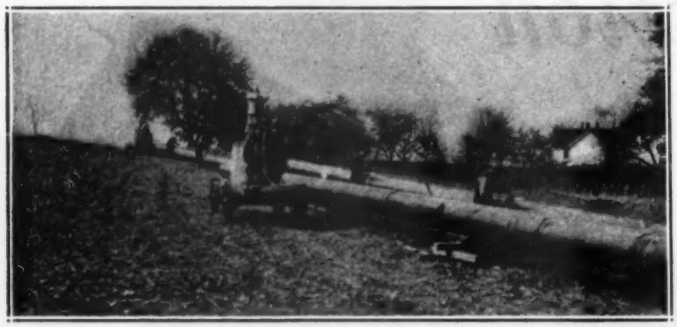
From the point of view of training inexperienced welders in the Lindeweld process, the most interesting experiment was the 50-mile section welded by the Columbia Gas & Electric Co. in Maryland. In this case, men were employed who had no previous experience in welding. They were given a short period of training by the gas company at Charleston, W. Va., under the direction of a service supervisor, after which they were sent to Maryland to begin work on the pipe line. These welders became proficient in making satisfactory rolling welds by the Lindeweld process. During the laying of this line the work of each welder was checked for quality. A considerable amount of bending was required on this line as the right of way ran through rough country, and the strength of the joints was continually tested by cold bending the pipe, which was 20-inch outside diameter, five-sixteenths inch wall, high carbon seamless pipe. Cold bending of pipe of this size is a splendid test of the strength and ductility of the joints. In several instances, the pipe buckled under the strain near the joints and even at the joints but in no case was there a weld failure. The test coupons made on this line developed an average tensile strength of 73,000 pounds per square inch. In the ductility test the average percentage of elongation was 24 per cent in one-half inch and 22 per cent in 1 inch.

The success of the Lindeweld process on this particular line proved conclusively that inexperienced men may be more easily trained in this method of welding than in former methods, and that the highest quality of work may be obtained from them under the proper supervision. The success of Lindewelding on this line insured its use on 100 miles of 20-inch pipe now under construction in Virginia.

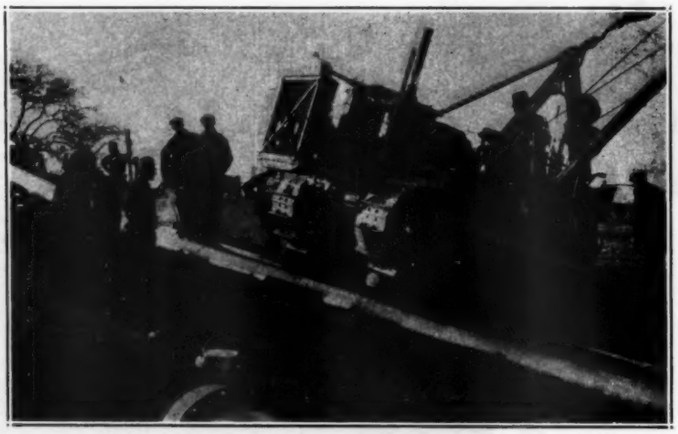
The most recent development in the Lindeweld process is the introduction of an entirely new design of blowpipe, known as the Lindewelder, which makes Lindewelding semiautomatic. In this blowpipe, the welding rod is supported vertically in a holder and feeds by gravity into the weld. The use of this blowpipe has further reduced the cost per weld and the time of the operation. This blowpipe has been used with great success by the Columbia Gas & Electric Co. on the 20-inch line under construction in Virginia.

The experience of a number of prominent pipe line companies has shown that the Lindeweld process will result in a saving of from 50 to 75 per cent of the time required to make a weld by the technique previously employed, depending upon the size of the pipe, in addition to a considerable reduction in the consumption of oxygen, acetylene and welding rod. No sacrifice of quality has been made for the benefit of the increased speed, as consistently higher strength welds are obtainable than by any welding technique previously employed.

The demand of the oil and gas industry for higher operating pressures and higher strength pipe has been met by oxy-acetylene welding with an improved welding method and higher strength welding rod. The development of the oxy-acetylene process has kept pace with the development of the pipe line industry itself.



Sections of 20-inch seamless pipe are welded together by the Lindeweld process.

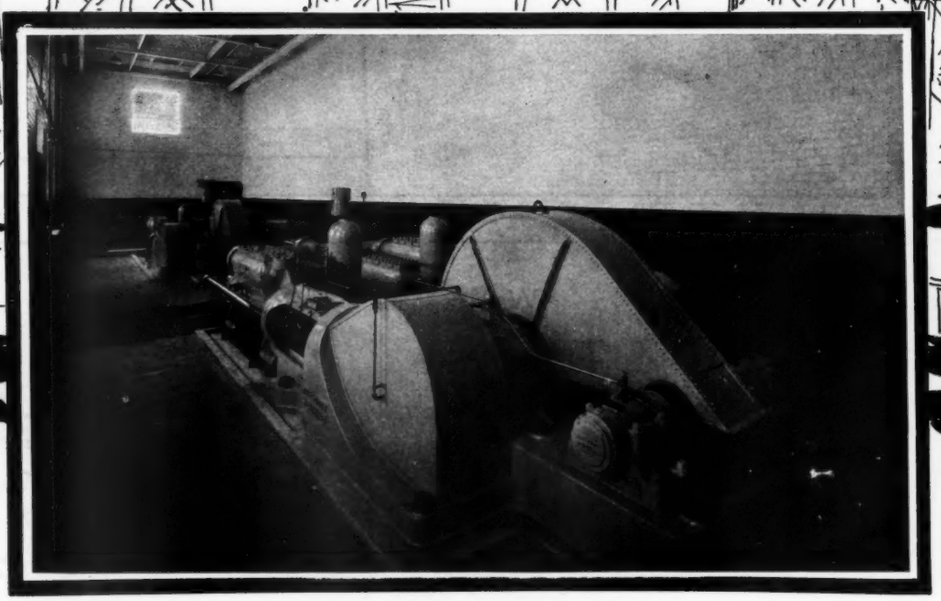


Cold bend made by tractor on large diameter Lindewelded pipe.

Hauling compressor station equipment in Kentucky.

Pipe strung along right of way.

COTT PUMPS



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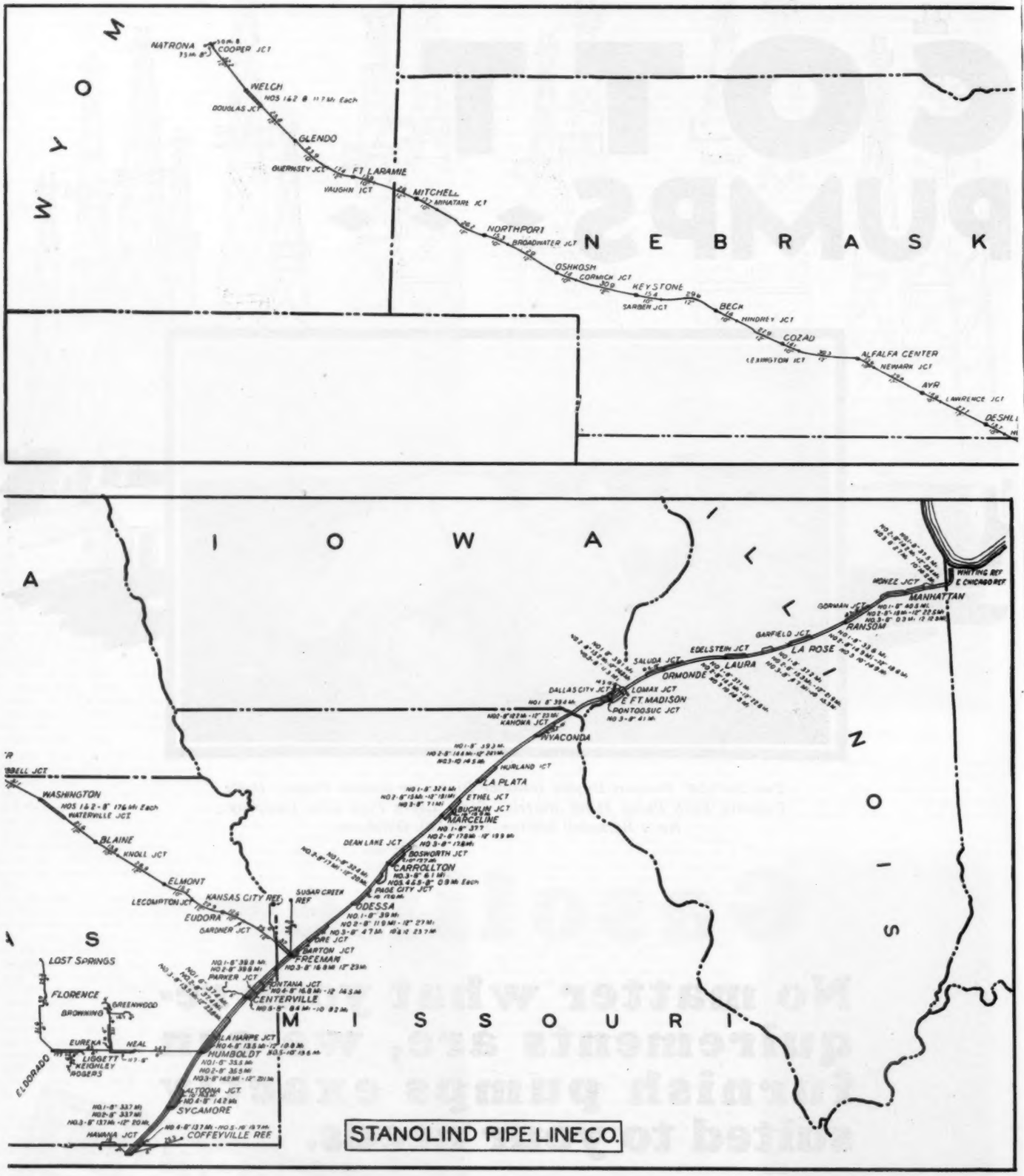
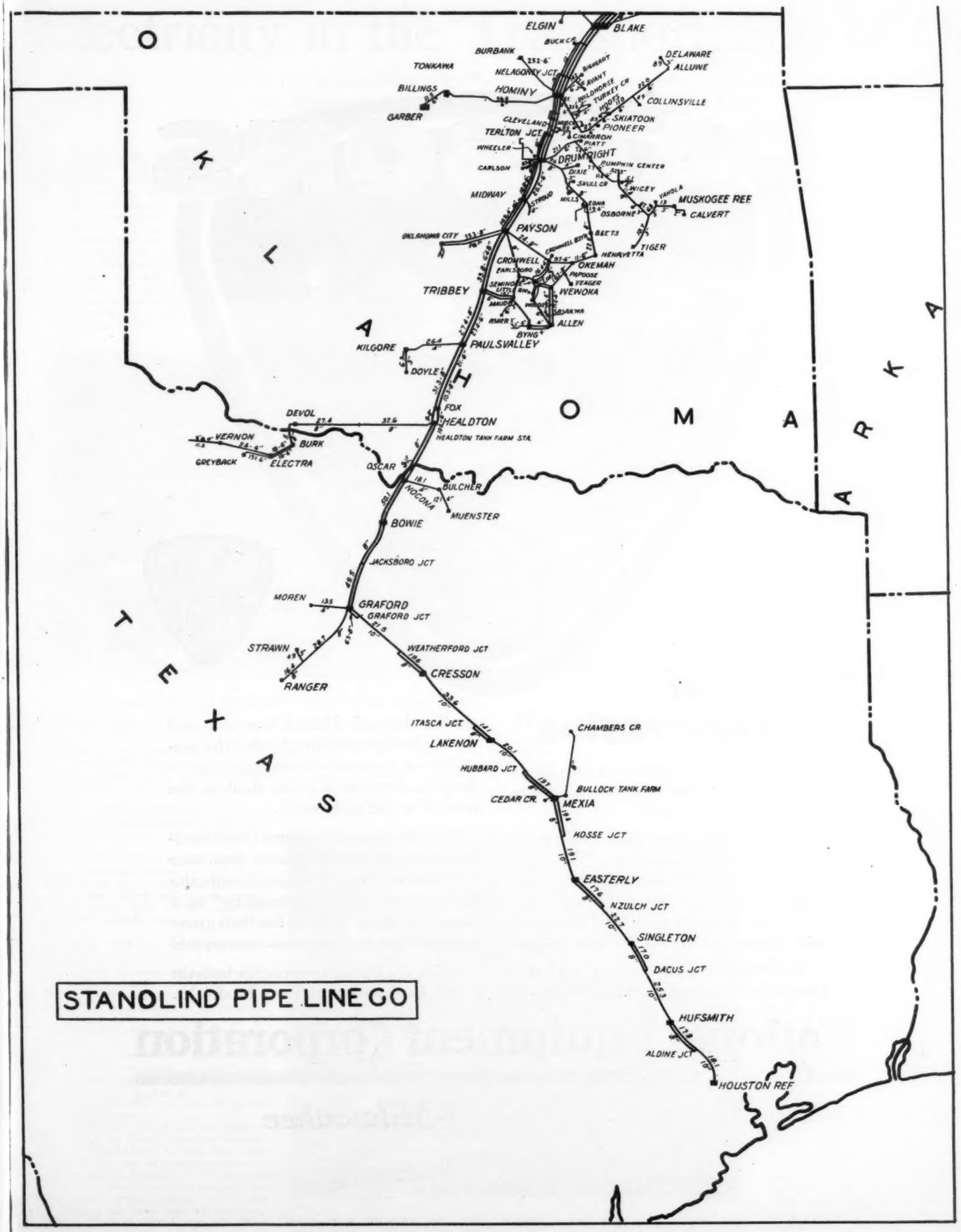


Top—Western part of upper section of map.
Bottom—Eastern part of upper section of map.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Electricity in the Transportation of Oil

Growing Use Shown by Fact 160,000 Horsepower in Electric Motors in Mid-Continent and Gulf Coast Pipe Lines

By G. R. Prout
General Electric Co., Dallas, Tex.

Until recent years the use of electricity in the operation of oil pipe lines was limited almost entirely to the telephone, telegraph, station lighting and small motor-driven auxiliaries. Steam engines or internal combustion engines furnished the power for driving the pumps and small generators which supplies the electrical energy for the station.

The use of electricity for oil pipe lines today, however, is quite a broad subject. Consequently, this paper will not enter into the communication phase as that is a complete subject in itself and has very little in common with the power phase, which this paper will endeavor to discuss.

During the past five years the oil pipe line transportation has not only grown rapidly but has turned more and more toward electric motors for driving the pumps.

Contributing Factors

There are many reasons for this tendency toward motors, the principal ones are:

1. Power companies have increased their generating capacities and have spread over the country with transmission systems which can readily furnish electric power from reliable sources to territories through which pipe lines extend.
2. This energy is available at reasonable cost.
3. Pump manufacturers have produced a centrifugal pump that can pump oil efficiently, and this type of pump lends itself most readily to motor drive.
4. It is highly desirable to keep the initial investment in the pipe line to a minimum. The electric motor-driven centrifugal pump is the least expensive type of pumping equipment available and consequently keeps down capital investment.
5. Electric units are easy to operate and easy to move.

The extent to which electric power is being used by the oil pipe line industry is best expressed by the fact that there is approximately 160,000 horsepower in electric motors installed in oil pipe line stations in the greater Mid-Continent and Gulf Coast areas. Nearly all of this equipment has been installed since November, 1926, at which time the Magnolia Pipe Line Co. erected a station at Westberry, Tex., near Beaumont, in which three centrifugal pumps driven by 250 horsepower, 3,600 r.p.m. motors were installed. This was one of the first successful stations to use this type of equipment in the central or Southwest.

Gathering Lines

In gathering line work the plunger pump and the steam, oil or gas engine comprised the most common equipment for pumping oil in the past. However, the electric motor is being used more and more for this service both on plunger pumps and centrifugals. Centrifugal pumps have been developed in the past year or two that can handle capacities down as low as 3,600 bbls. per day against the heads required for gathering line work and these pumps have acceptable efficiencies. Since the centrifugal pump is essentially a high-speed device when operating at high pressures, the electric motor is admirably adapted for driving these pumps in gathering service.

Automatic control equipment has been developed for the automatic operation of gathering line stations. This equipment will automatically start and stop the pump by means of a float switch, pressure switch or some other device controlled by the height of the oil in the tank or pressure in the line. This equipment also affords protection against pumping into a line break or against a closed gate valve. The operation is entirely automatic and no operator is necessary at the station. Provisions are made to control the pump manually for test purposes and emergency operation.

The electric service most commonly used on gathering line work is 440 volts, 3 phase, 60 cycle. Practically all of the oil fields are served at this voltage for pumping wells and naturally the gathering equipment would be served at the same voltage.

The squirrel cage induction motor of the normal type or of the low starting current type has been used on centrifugal pumps, while wound rotor induction motors or high starting torque squirrel cage motors have been frequently used on plunger pumps.

In some cases operating companies have used the two-speed wound rotor induction oil well pumping and pulling motor rated 33-15 horsepower or 55-25 horsepower, 1,200-600 r.p.m. and have operated it either on the high or low speed side as the occasion required.

The advantages of motor-driven pumps of either type for this service are:

1. Easy to transport and install.
2. Lower first cost.
3. Less maintenance and attention required.
4. Possibilities of the use of automatic operation.

Trunk Lines

In trunk line work it is usually expected that the line will operate at a fairly high capacity factor over a period of years, and consequently the problem of which type of drive and which type of pump to use has received due consideration. Even on the trunk line, however, the desirability of low investment is not to be overlooked.

At the present time there are over 400,000 bbls. per day in pipe line capacity out of the West Texas producing area and yet the total quantity now being pumped out is only about 200,000 bbls. per day. Some of these lines pump full capacity only a very short time and have since operated at reduced capacity.

The fixed charges on a station are going on regardless of whether the station is running or not and while it is unusual, perhaps, to shut a station down and not move the equipment, this does happen occasionally. Sometimes stations are dismantled and the equipment moved to a warehouse to await requirements from some other line. In this latter case the fixed charges are also going on.

The ease with which motor-driven pumps can be moved is an advantage to be considered. The total weight of one 30,000-bbl. per day centrifugal pump with its motor mounted on its bed plate

Prescott pump driven by a Type TS-600 H.P. 2200-V. Synchronous motor

3 G-E Type Kt, 400-H.P., 3600-R.P.M., 2200-Volt, 60-Cycle Squirrel-Cage Induction Motors each coupled to Worthington oil line centrifugal pumps.

Sinclair-Texas Pipe Line Co.'s station at Oklahoma City, Okla., capacity 60,000 bbls. daily at 700 pounds. Two 500 H.P., 3600 R.p.m. Byron Jackson centrifugal 6-inch three-stage oil line pumps.

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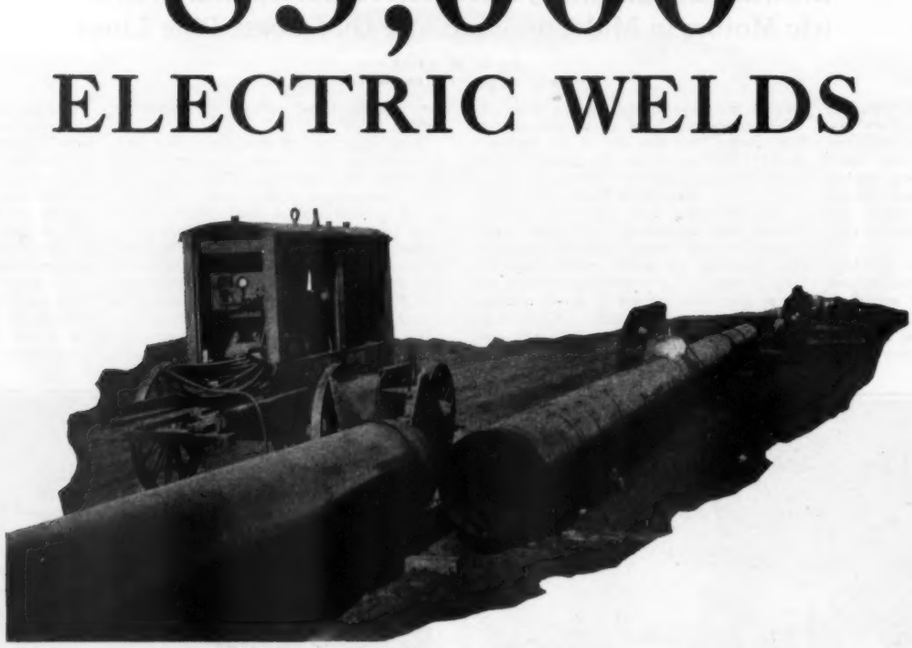

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We are at present electric welding on 18, 20, 22 and 26-inch pipe for:

Columbia Gas Construction Company (100 miles)
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Southern Fuel Company (California) (124 miles)

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is about 7,500 pounds. Two of these units operating in series can handle efficiently 30,000 bbls. of crude per day against a pressure up to 750 pounds. Each of these units is about 10 feet long by 4 feet wide by 4½ feet high. Consider the ease with which a station using such equipment can be moved from one location to another.

In the present rush of the new East Texas Field one major company has moved from a West Texas line nine motor driven pumps each capable of handling 50,000 bbls. per day. Another major company has moved four 30,000-bbl. per day units, while still another has moved two units.

Since the unit need not be disassembled for transportation, the time required to move and install such equipment is very short and the unit is easily handled.

The weight of two 15,000-bbl. plunger pumps with necessary motors is approximately 130,000 pounds.

Automatic Operation

An advantage afforded by the electric station is the ease with which automatic operation can be incorporated.

While most of the work having to do with automatic control of stations has been done with motor driven centrifugal pumps, motor driven reciprocating pumps could be automatically controlled although the problem would be a little more difficult.

Two methods of automatic control and a combination of the two have been worked out. One of these is, control of the station by pressure or flow of oil in the line while the other is the manual control of the station from a remote point, say the dispatcher's office or the upstream station, by means of supervisory control equipment. Enough work has been done with both types of control to prove that they are practical and it is only a question of time until one or both of these methods will be widely used.

Automatic control by flow of oil or pressure in the line applies more readily to the motor driven centrifugal pump station. The conventional station of this type employs two pumps in series for full capacity at full pressure. One pump running alone in each station will give half pressure and approximately 70 per cent capacity. Two pumps in series will give full pressure and full capacity.

The control developed for automatic pressure control is so arranged that if one pump is started in the originating station, one pump in each of the downstream stations will start. If the second pump in the originating station is started the second pump in each downstream station will start and run so long as both pumps are running in the originating station. In this way a complete line of centrifugal pump stations can all be controlled by operations at the head station. This type of control also includes protection against running each station against a closed gate valve and provides for shutting the station down in case of a line break. Provisions can also be made for shutting down pumps and motors in case of hot bearings and other emergency conditions.

Supervisory Control

The supervisory control equipment provides for the operation of the station from some remote point. This equipment is available in two forms, visual or audible. It is also possible to get a combination of the two types.

This equipment allows someone at the controlling point, say the dispatcher's office to control the operation of a station a number of miles away by means of control switches or a telephone dial. He can open and close motor operated gate valves, and start and stop motor driven pumps at will and have visual and audible signals to tell him what he has done. Automatic shutdown can be provided for in case of a broken line, hot bearings, blown gaskets or other emergencies and the one controlling the operation will be notified that the station is shut down and the reason therefor.

This type of equipment requires that control wires be strung between the controlling point and the station. The telephone wires, however, can be used under some conditions.

A combination of the two above methods of control can sometimes be used to advantage. This arrangement allows the dispatcher to select the stations that are to run, by opening or closing gate valves, but after he has done this, pressure in the line actually controls the pumps although he has indications of the running or stopped condition of the pumps and also would get indication of an emergency which caused a shutdown.

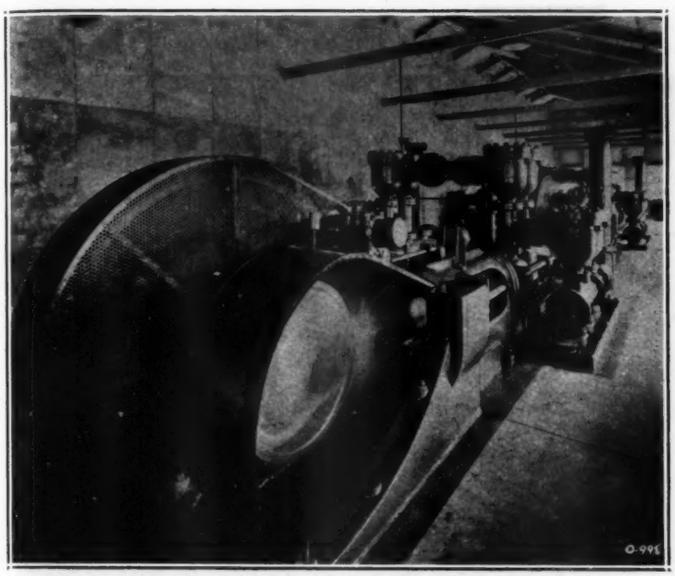
Diesel or Steam Stations

In stations that use Diesel or steam engines for driving the pumps electricity is usually furnished by electric generators for lighting and for driving auxiliaries. Frequently these generators are driven by belt, V-belt or chain from the engine or pump shaft and furnish direct current at 115 volts. Since the requirements for pumping sometimes necessitate running the engines at reduced speed, special generators which can maintain 115 volts at the various speed conditions, have been developed. These generators range in size from 5 to about 25 k.w.

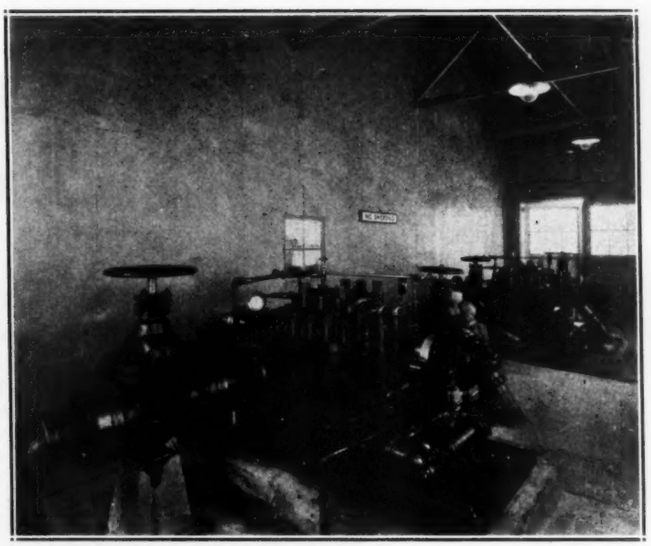
In some stations a separate Diesel engine direct connected to an alternating current three phase, 60 cycle generator has been used. This type of equipment has the advantage of constant voltage and continuous electric service regardless of whether the pumps are running at full speed or not. It also would provide electrical energy even though the rest of the equipment in the station were shut down.

Conclusions

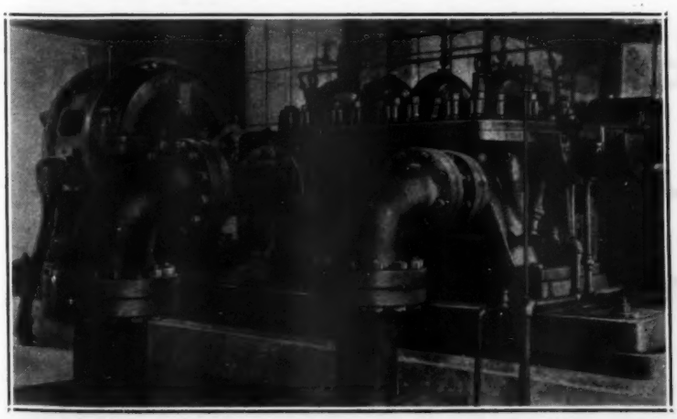
1. Electric motors are playing an important part in driving centrifugal pumps and reciprocating pumps in the oil pipe line industry. This is evidenced by the fact that about 160,000 horsepower in motor capacity is now installed in oil pipe line stations in the Central and Southwest.
2. Power companies are in a position to furnish and are furnishing electrical energy from reliable sources over networks of transmission lines to pipe line pumping stations at reasonable cost.
3. Motor driven centrifugal pumps that have relatively low first cost and acceptable efficiencies are available for pipe line work.
4. Motors can be readily applied to plunger pumps.
5. Motor driven pumps keep first cost to a minimum.
6. Motor driven pumps are readily moved from one place to another.
7. Automatic control can be readily applied to the motor driven pump station.



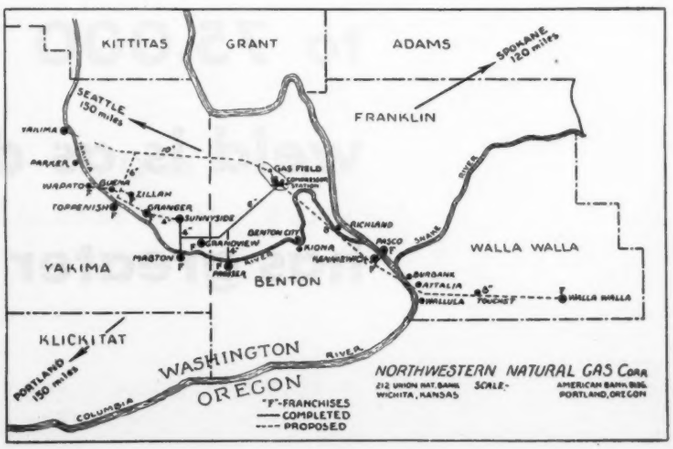
2 National Transit Pumps driven by Type KT-200, H.P. 2200-V. Motors.



2 Cameron oil pipeline centrifugal pumps driven through wall by 2 Type KTP, 250-H.P., 1800-R.P.M., 2200-Volt Induction Motors.



Allis-Chalmers Mfg. Co.'s 8"x5" M-J-4 Stage Bronze Pump installed at Shell Pipe Line Co.'s Baylor Station near Seymour, Texas.



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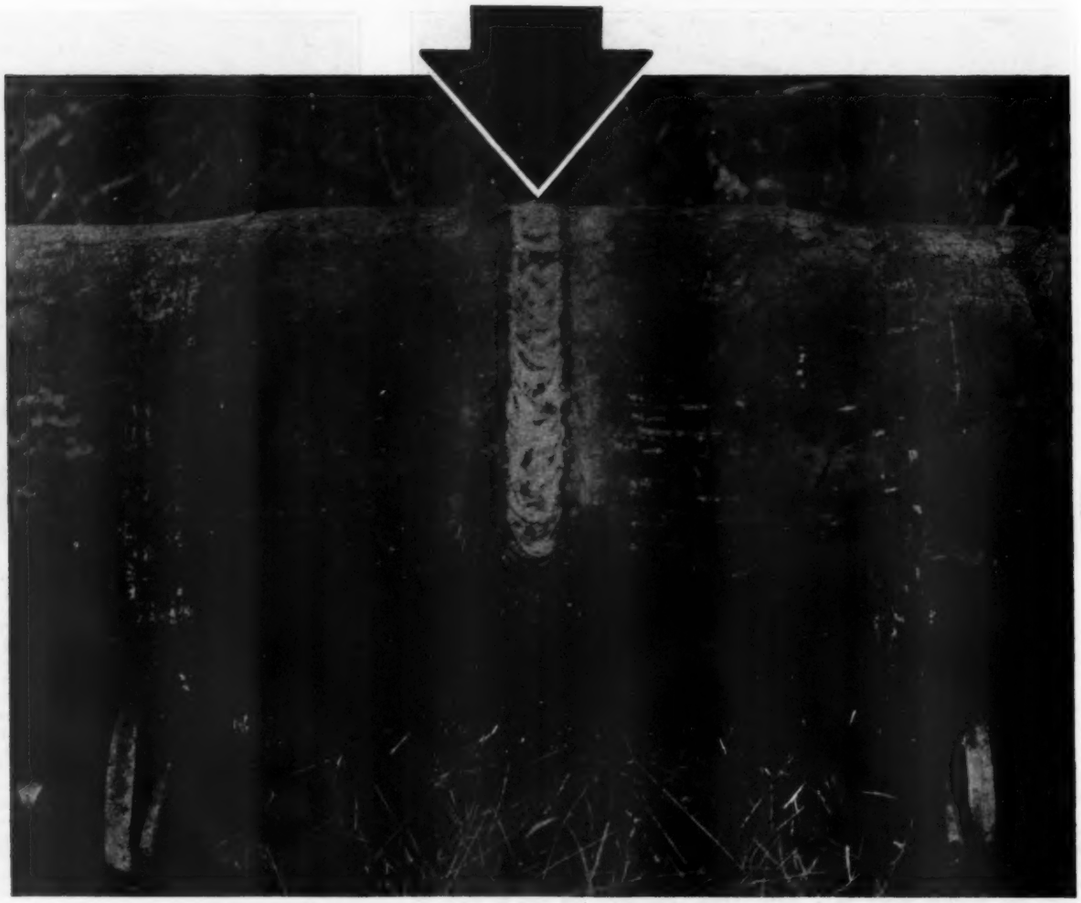

has a tensile strength of 60,000 to 75,000 lbs. per sq. inch . The weld is as ductile as the pipe and has greater resistance to corrosion.

. . . is one of the 241,352 joints, of 4" to 26" diameter, arc welded in pipe lines during 1930-1931 by the LINCOLN "SHIELDED ARC" PROCESS using LINCOLN "FLEETWELD" ELECTRODES and LINCOLN "STABLE-ARC" WELDERS

Speed of welding is approximately one minute for each inch diameter of pipe

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Butane Plants Supplement Gas Lines

Considerable Pipe Mileage Involved in Distributing Systems in Towns Away From Natural Gas Lines

By R. E. Aitcheson
Executive Vice President, Natural Gas Corp. of California, Natural Gas Corp. of Oregon and Natural Gas Corp. of Washington

The many large gas transmission systems built during the past few years have brought natural gas to most of the large cities of this country, and have given the comfort and convenience of gas service to numerous smaller communities which have heretofore been denied the benefits of this fuel.

There are, however, still hundreds of smaller cities ranging in population from 800 to 30,000 which are beyond the economic range of these large transmission lines and their branches. To these communities the development of air-butane gas plants supplies the answer to a long felt need—that of an economical, quick and convenient fuel for both domestic and commercial use. These butane plants may thus be regarded as supplementing the active pipe line developments of recent years.

As a matter of fact, while such plants do not require any appreciable transmission pipe line, they do involve considerable mileage of smaller sizes for distribution systems. As an indication of what this means to the pipe line business, it may be of interest to know that during the past year Natural Gas Corp. of California, Natural Gas Corp. of Oregon and Natural Gas Corp. of Washington alone have laid a total of approximately 400 miles of distribution system in these three Pacific Coast states.

Typical control room.

More Activity This Year

This figure takes into consideration only the 1930 construction program of these companies, which should be exceeded before the end of 1931, and has been the major development of air butane on the Pacific Coast, although other companies have put in small distribution systems, and in other sections of the country similar developments are taking place on a large scale.

This new service is made possible by a simple but interesting process, and that used on the coast is the result of extensive surveys and studies made by engineers of Standard Management and Operating Corp., management company for the trio of natural gas corporations, which are subsidiaries of Pacific Public Service Co.

The butane or "Bu-Gas" used by these companies is secured from plants at Huntington Beach and Richmond, Calif., where additional equipment and storage facilities have now been installed to supply the demands of the gas operating companies. Since Bu-Gas is a gas at ordinary temperatures and atmospheric pressure, it must, for economic handling, be recovered, stored and transported under sufficient pressure to transform the gas into a liquid.

Especially designed tank cars, built in accordance with the Interstate Commerce Commission requirements and those of the American Society of Mechanical Engineers, are used for delivering Bu-Gas to the plants. These are of heavy steel construction, with riveted and welded seams. The tank cars now in use are of 10,000-gallon capacity, with no bottom outlets; but within the dome are special unloading facilities consisting of two outlet connections, a high-pressure top connection and the necessary safety valves and thermometer wells.

Upon arrival at its destination, the tank car loaded with liquid Bu-Gas is spotted on the operating company's spur track, adjacent to the special unloading terminals. These consist of two liquid lines, connected by means of a flexible hose, with two tank car outlets and running underground to the liquid storage container on the plant grounds. In addition, there is provided a 1-inch high-pressure line designed to aid in unloading.

Unloading Tank Cars

Upon arrival at its destination, the pressure of the loaded car of Bu-Gas may be anywhere between zero and approximately 80 pounds per square inch, depending upon the temperature of the liquid in the car, which in turn depends, of course, upon the atmospheric temperature through which it has been traveling.

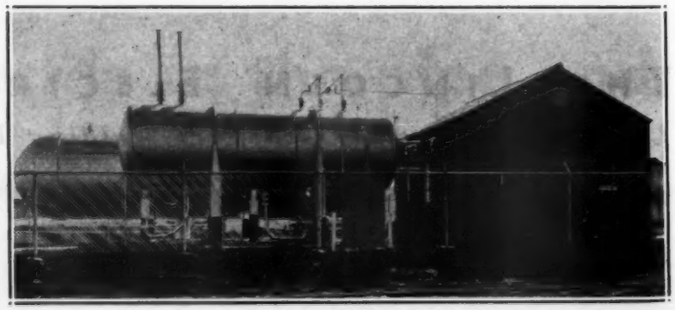
Generally the tank car pressure will, at the start of unloading, exceed the pressure in the plant storage container, so that unloading will proceed automatically as soon as the tank car is connected up and its discharge valves opened. Sometimes the contents of the tank car will be enough warmer than that of the storage tank to completely unload the car before pressures equalize. However, in most instances the latter part of the unloading operation must be carried on with the help of pressure applied on top of the liquid in the car—this pressure being secured by connecting the plant gas storage tank throughout suitable pipe and hose connections to the high-pressure fitting in the tank car dome above mentioned.

The liquid Bu-Gas storage holders are similar in appearance and construction to the tank car, and are placed horizontally on two piers. The sizes of the tanks vary from 6 feet in diameter by 20 feet long to 8 feet in diameter by 40 feet long. In addition to properly installed safety valves and blow-off pipes, each tank is equipped with a liquid gauge calibrated in gallons, in order that the outgo may be recorded daily.

The process of producing from the liquid butane in the storage tanks a gas suitable for domestic and commercial use is relatively simple. Alongside the Bu-Gas container is a finished gas storage tank. This tank, in the plants operated by the properties being described, ranges in size from 10 feet in diameter by 40 feet long to 12 feet in diameter by 50 feet long. Finished gas storage capacity is provided for approximately one-half of an average day's demand in the communities served, thus establishing a safety factor to offset any temporary plant shutdown and assuring the consumer of uninterrupted service.

Pressure in the gas storage tank is automatically maintained between limits of from 60 to 75 pounds. When the lower pressure is reached, electrical apparatus

Typical compressor room showing sensitive compressor regulators at left; surge chamber in center, tank containing odorant liquid suspended from rafters over compressor.



Exterior view typical plant with butane liquid tank in foreground, finished gas storage holder in rear, and operating equipment in fireproof building at right.

Now you can understand why every user keeps on buying *Allsteel* Pipeline equipment

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ENGINEERS : CONTRACTORS
EXCHANGE BANK BLDG.
PHONE 2-8648
TULSA, OKLA.

March 23rd, 1931.

The Allsteel Products Manufacturing Co.,
231 West English Street,
Wichita, Kansas.

Attention: Mr. H. R. Laudermilk.

Gentlemen:

In reference to your new type Live-boom pipeline winch, of which we now have six, and especially of the size adapted to the Caterpillar Twenty, we have nothing but praise.

In our opinion it is far ahead of all other models, both in utility and strength, and our work has been of such nature as to thoroughly test them for both qualities. The "Twenty" model mounted on the wide-tread caterpillar is such an improvement that it is doing more easily and cheaply, work which formerly required a Caterpillar Thirty.

The time has arrived in pipeline construction where all equipment must be closely watched for such things as utility, reliability, economy of operation and the amount expended for depreciation and repairs. We wish to congratulate your company on their contribution to the savings which may be affected in those items.

Yours very truly,

SOUTHWESTERN CONSTRUCTION CORPORATION

AMH/B

By A. M. Horrall
(A. M. HORRALL) President.

EVERY pipe-line contractor who has purchased CARDWELL ALLSTEEL double-drum, live-boom, pipeline winches has followed his initial purchase with orders for additional equipment. The letter reproduced here explains the reason.

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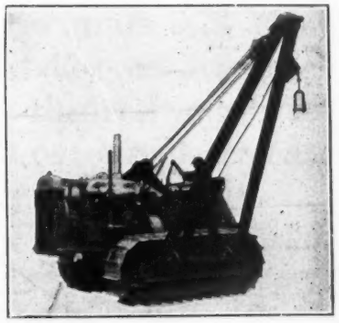

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starts up a compressor which draws in a correctly proportioned mixture of Bu-Gas vapor and air, and pumps it into the storage tank. The vapor comes out of the top of the Bu-Gas storage tank in which the liquid has been heated to the necessary vaporization point and flows into the plant at a pressure of about 20 pounds per square inch. Here it goes through a series of regulators which step the pressure down and deliver the Bu-Gas vapor into an especially constructed compressor intake chamber where it mixes with the air being drawn in.

Check Heating Value

A sample line runs from the discharge of the compressor to a control device. A small flame supplied from this sample line burns continuously in the control apparatus; and if the heating value of the mixed gas produced tends to vary by even a small amount from the desired value, the control apparatus automatically operates a butterfly valve which raises or lowers the percentage of Bu-Gas in the mixture, as may be required.

In all of our plants, gas with a heating value of approximately 550 B.t.u. per cubic foot is being produced. This is equivalent to that of manufactured gas in use in various cities throughout the country.

By using the process above described, it has been found that the finished gas is almost entirely dehydrated, which obviously reduces to a minimum maintenance difficulties usually experienced in other types of less dry gas. This clean, dry, noncorrosive gas minimizes the necessity for gas appliance adjustments and lessens deterioration of mains and services while the accurately regulated B.t.u. value of the gas produced insures dependable and constant service to the ultimate consumer.

As a safety factor there is introduced into the gas as it leaves the compressor a pungent odorizing substance. The Bu-Gas itself is practically odorless, but with the addition of this odorant, minute leaks can be readily detected. The odorizing substance is produced by Standard Oil Co. of California and is being extensively used throughout the United States, both in large natural gas transmission and distribution systems and in numerous other butane gas plants.

The plant building is of an entirely fireproof construction—steel frame with red tile walls and red metal tile roofing. The building is divided into two rooms separated by a gas-proof wall, with separate entrances into the room containing the control apparatus and the compressor room.

Distribution System

A representative plant, such as that described, has a capacity of about 150,000 cubic feet per day, while the average consumption will be only between 40,000 and 50,000 cubic feet, at least during the first year. This means that ample provision has been made for immediate growth and expansion in each area.

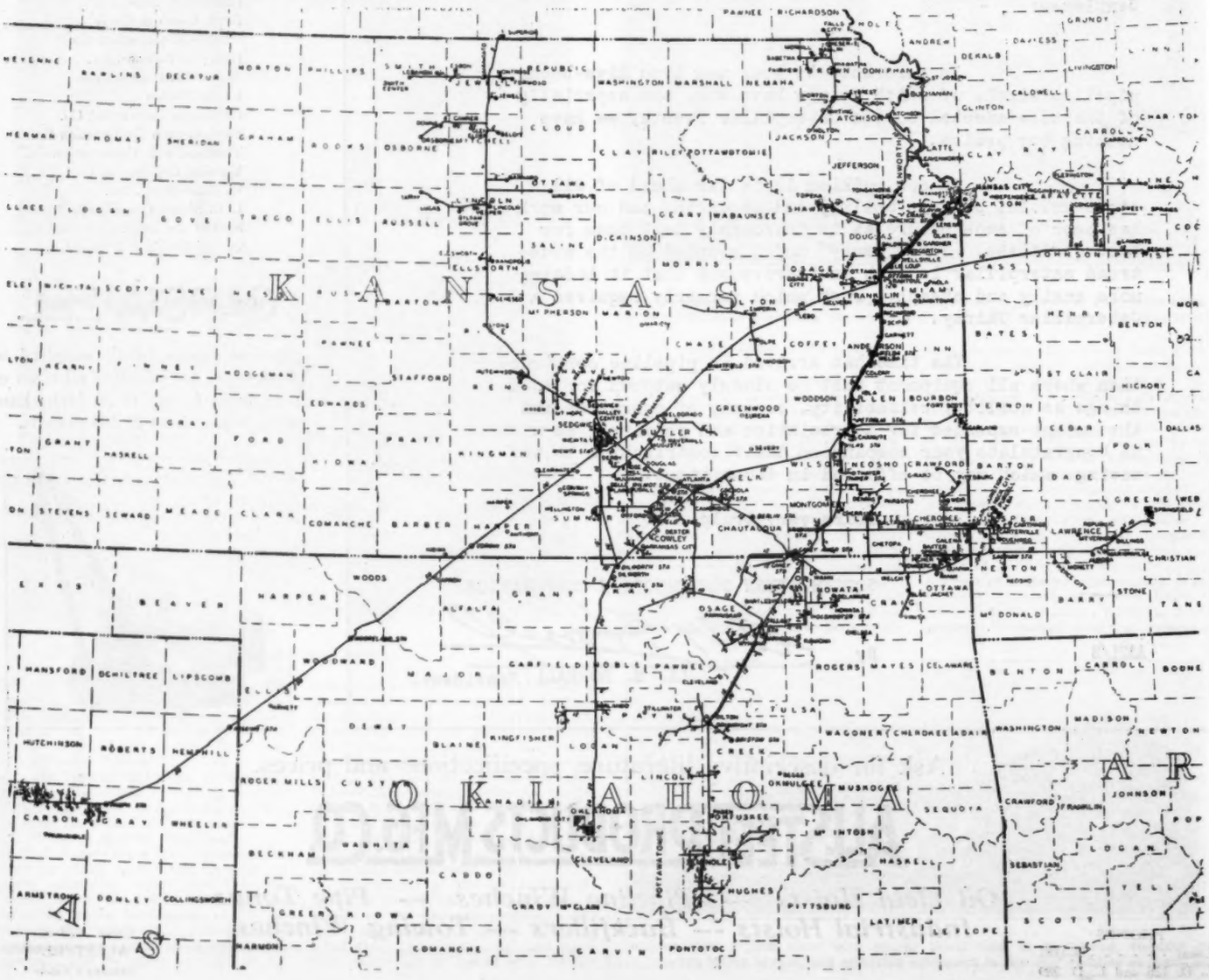
The distribution systems through which the gas is delivered to the consumers are the same as would be required with any standard manufactured or natural gas system. The economy of installations such as have been described lies in the low cost of the plant, which it is estimated amounts to only about one-fourth to one-fifth the cost of a manufactured gas plant. This, together with the reduced operating costs which result from the practically automatic operation of the plant, makes it possible to supply economical fuel to small communities. In fact, towns with only a possible 200 consumers may be profitably served, and plants may, of course, also be constructed to give adequate service to much larger communities.

As this is written, plants of this type have already been placed in operation in Vacavile, Suisun, Fairfield, Isleton, Rio Vista, Brawley, Calexico, Dunsmuir and Yreka in California; Bend, Klamath Falls, La Grande, Cottage Grove and Coquile in Oregon; and Camas, Anacortes, Shelton and Port Townsend in Washington. Several other additional plants will go into operation soon throughout this territory.

In fact, where pipe line distribution ends, there air-butane gas service begins—and residents of the country or isolated communities may now enjoy all the advantages and convenience of fuel available to their city neighbors.

Hard going through the mud in Texas.

MAP OF MID-CONTINENT NATURAL GAS SYSTEM, CITIES SERVICE GAS CO.



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—KNOWLEDGE

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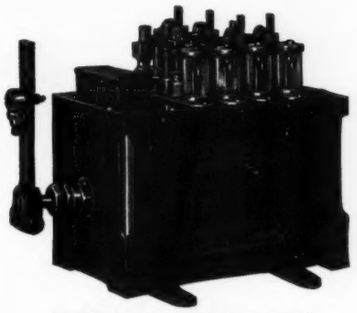
PIPE LINE CONTRACTORS

712 Fisk Bldg.

Amarillo, Texas

Re: DRIVES—
McCord "LD" Lubricators



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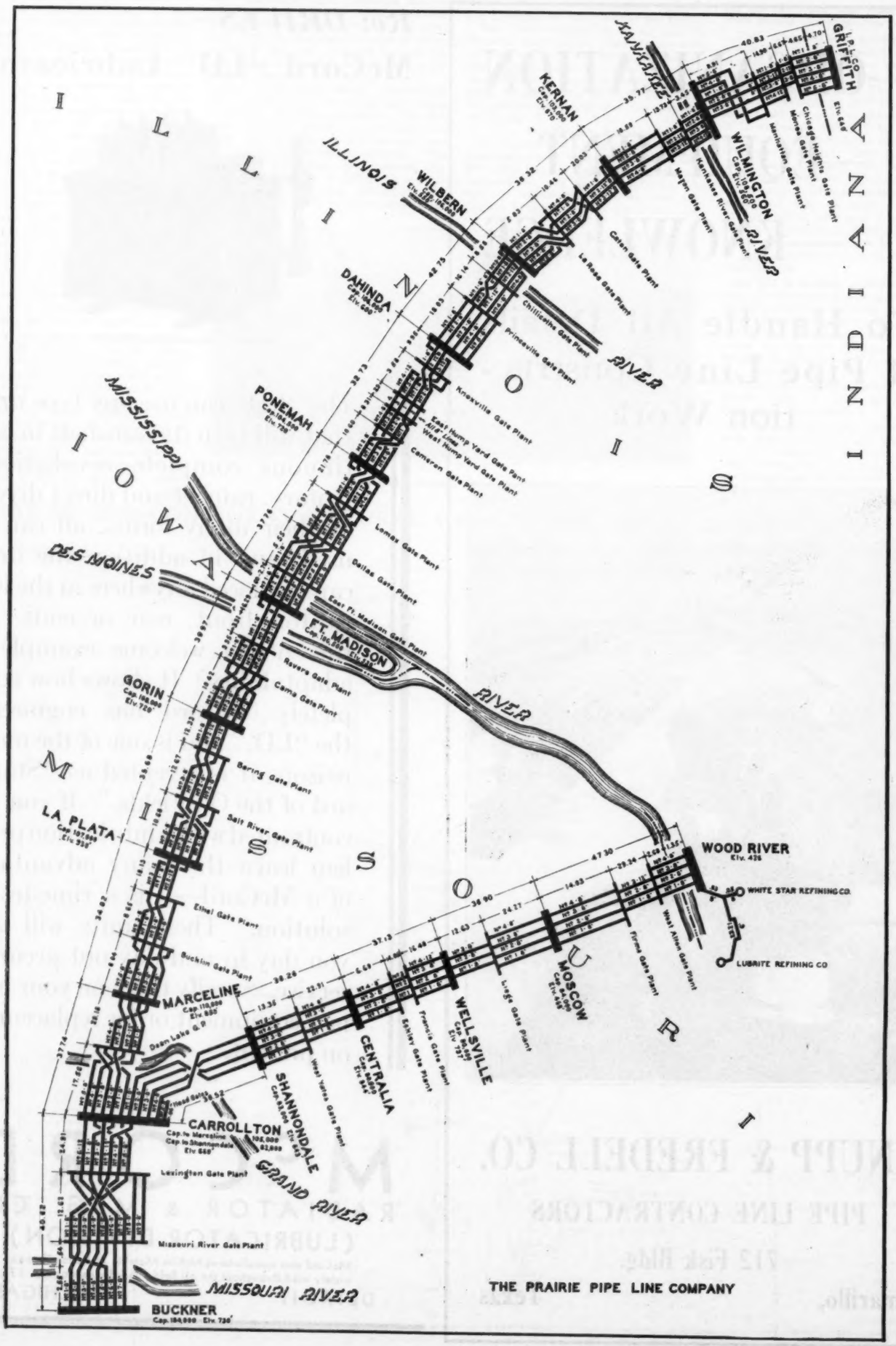
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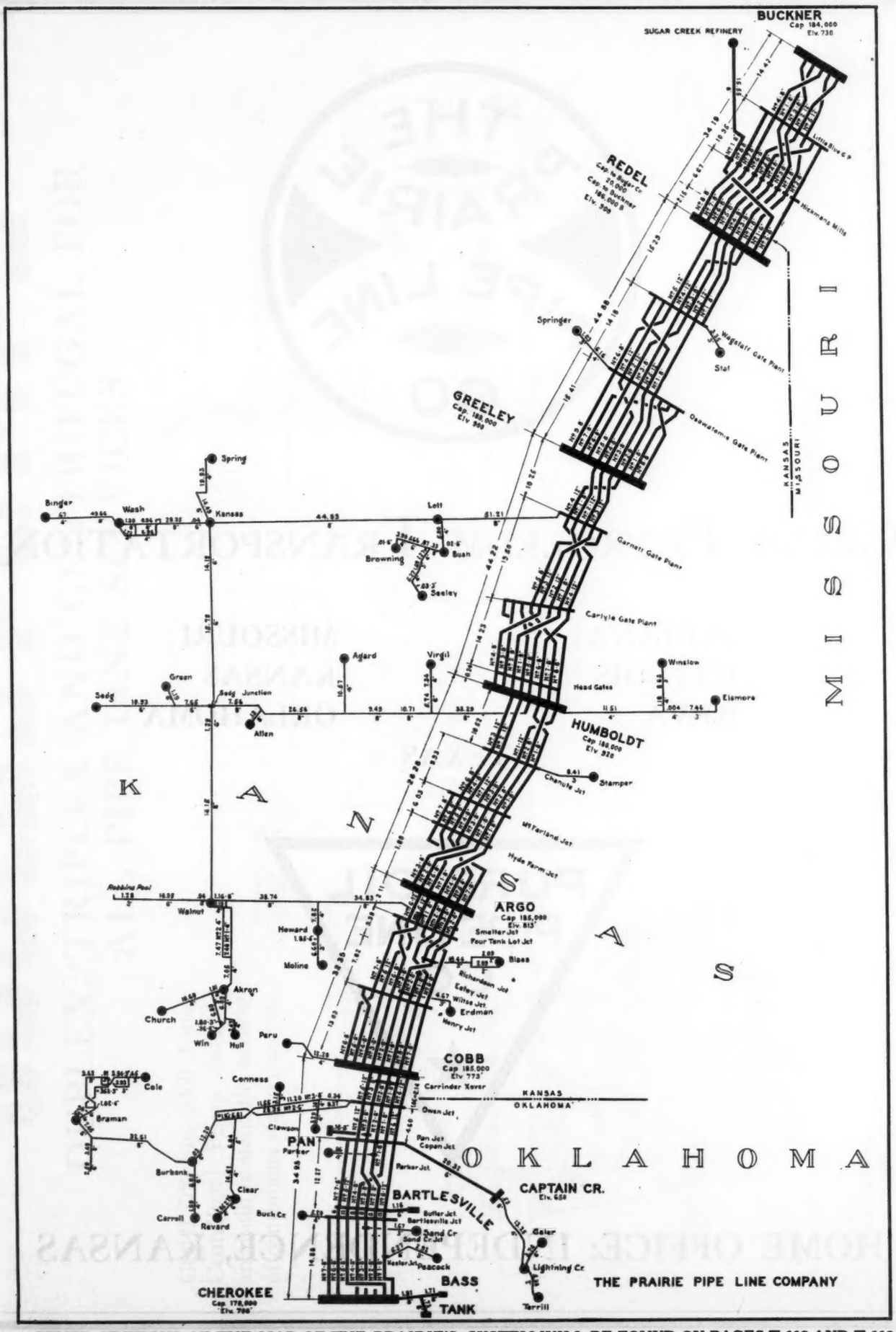

OTHER SECTIONS OF THE MAP OF THE PRAIRIE'S SYSTEM WILL BE FOUND ON PAGES T-112 AND T-113

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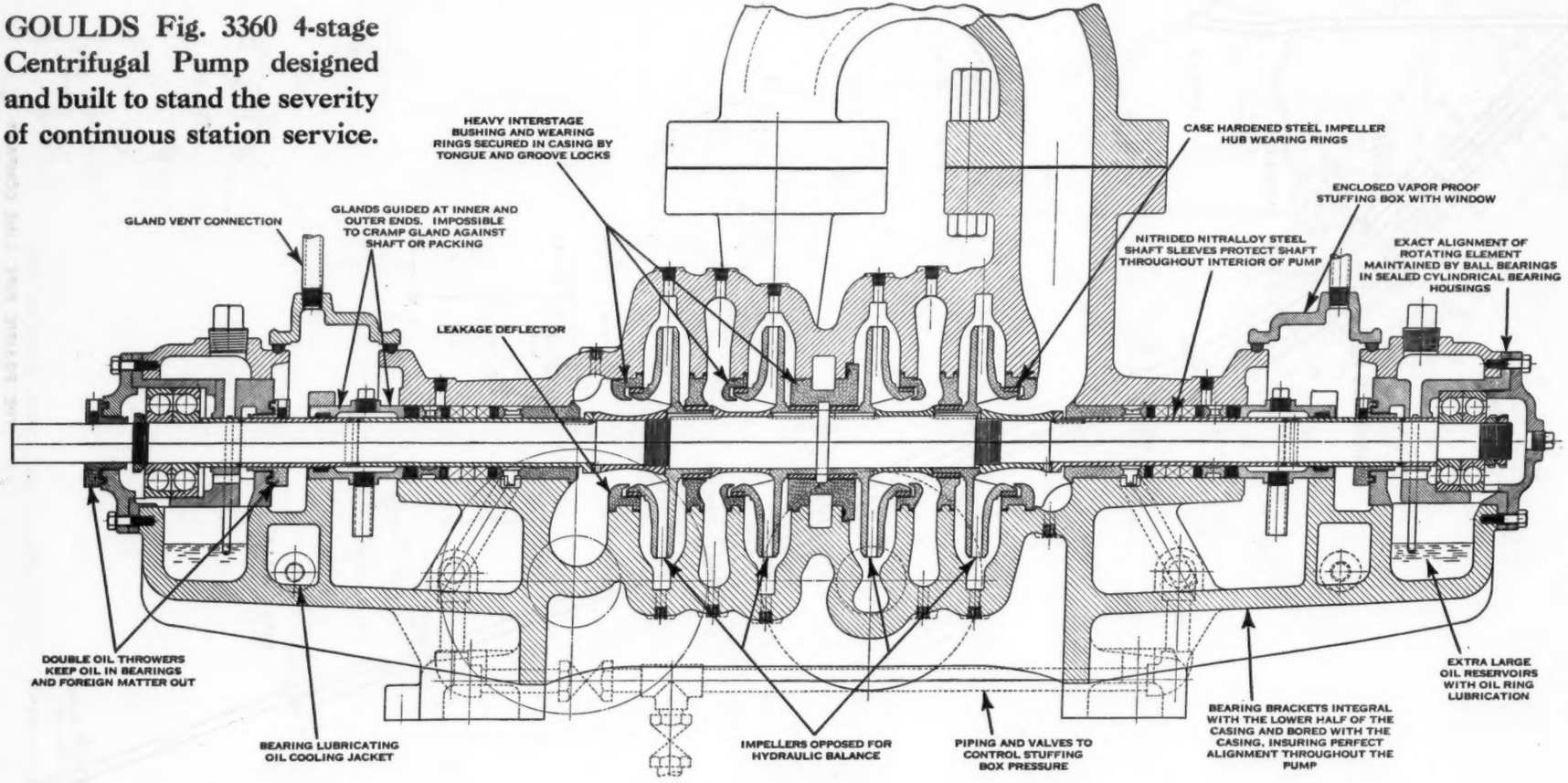
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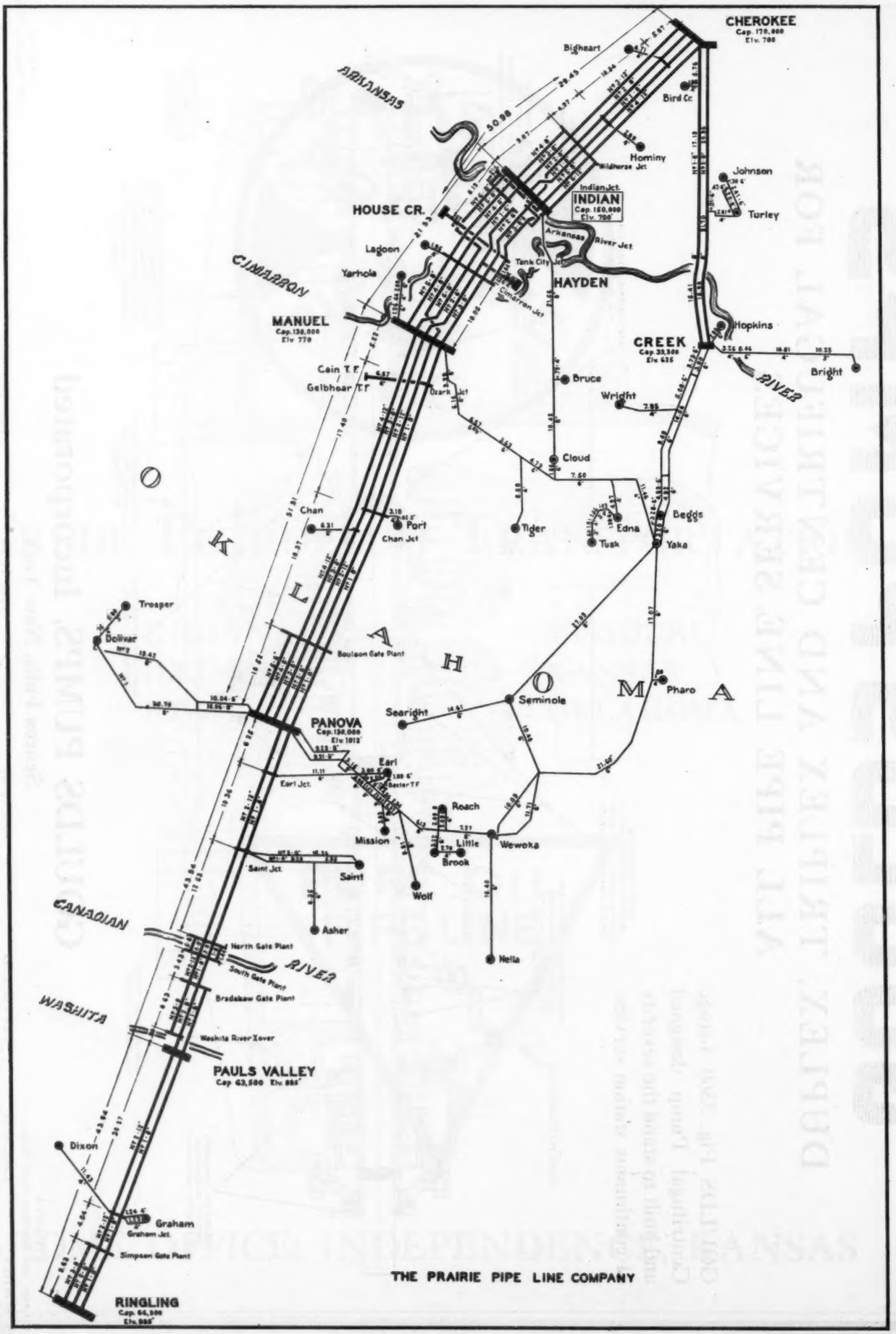
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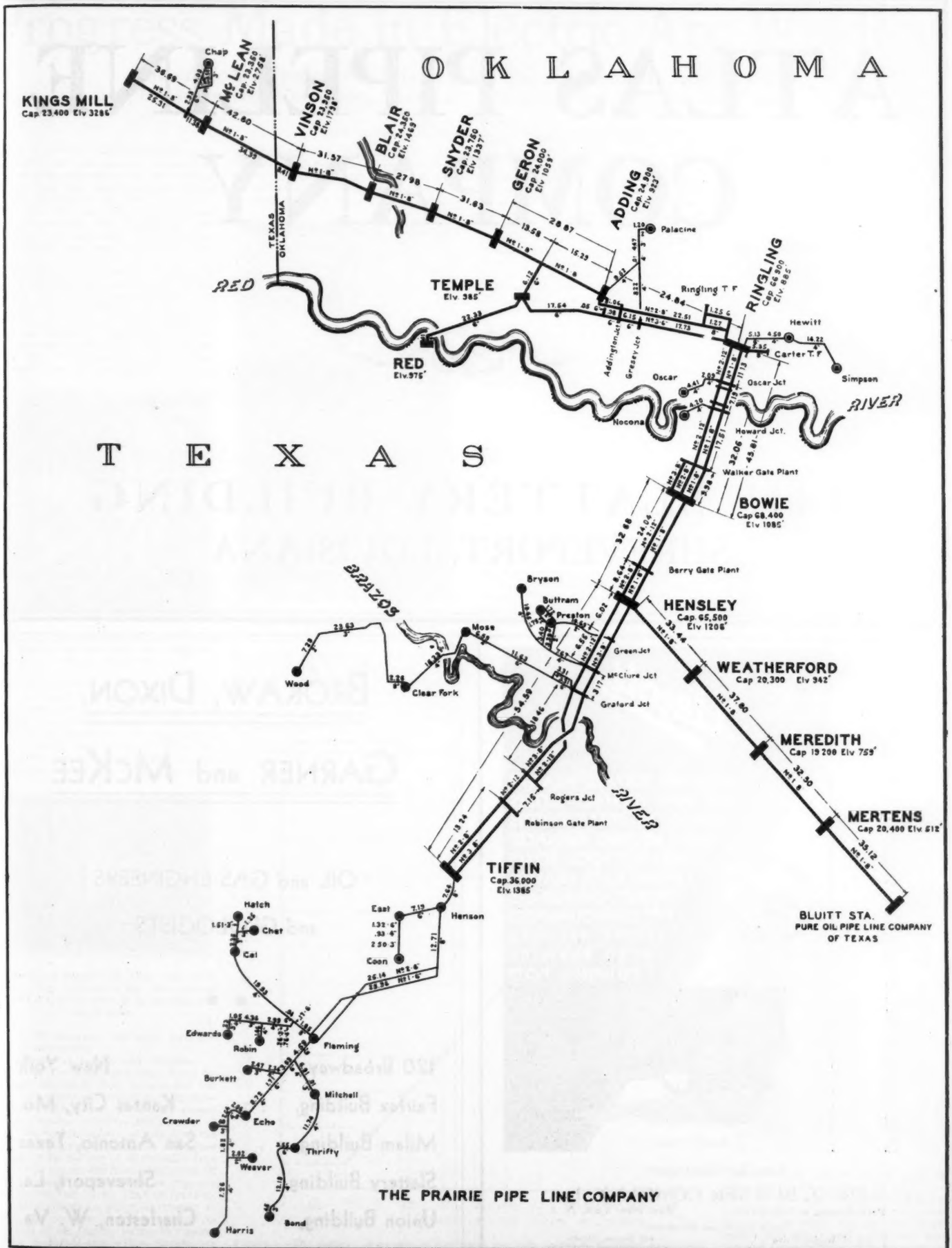

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Progress Made in Electric Arc Welding

Shielded Arc Produces Welds of High Tensile Strength, Ductility and Resistive to Corrosion. Greater Welding Speed Obtained Also

By C. M. Taylor
Vice President, Lincoln Electric Co., Cleveland, Ohio.

New discoveries and improvements in the electric arc process are reflected by a great improvement in the arc welding of pipe lines. One year ago in an article entitled "Trends in Oil Pipe Line Practice," The Oil and Gas Journal said: "Notwithstanding the difficulties that have been encountered in the use of electric welding, the trend will be to that type."

Less than a year ago, the application of the shielded arc process of electric welding to pipe line construction came into general use. Today almost 3,000 miles of pipe line have been welded or are being welded by this modern method. One contractor, who has welded 75,000 joints with the shielded arc, reports that although most of the pipe has been in

Figure 1—An arc welded plain end joint with backing-up ring such as commonly used on gas lines.

the ground for six months, not a single leak or failure has been discovered.

The use of the shielded arc results in a dense, tough weld, highly resistant to corrosion, as ductile as the pipe metal, with a tensile strength of 60,000 to 80,000 pounds per square inch. The shielded arc process increases welding speed from

Figure 2—A double bell joint with backing-up ring fabricated by the shielded arc. This type of joint is in common use on oil lines.

150 to 300 per cent, depending upon operating conditions.

Eliminates Oxides and Nitrides

One of the great problems faced by welding engineers and technicians has been the occasional formation of unsatisfactory welds. These are usually caused by the presence of oxides and nitrides in the ambient atmosphere surrounding the arc. These oxides and nitrides have been eliminated by the use of an extruded type of heavily coated electrode. The metal of this electrode melts faster in the arc than the coating burns. Thus the projected coating forms in effect, a crucible in which the electrode metal is melted. As the edge of the coating burns, two gases, carbon monoxide and carbon dioxide, are given off. Carbon dioxide, a stable gas at high temperatures, will not break down into its component parts, and therefore, serves as a shield to exclude the air from the molten metal. Carbon monoxide, having only one part oxygen, is not a stable

Figure 3—Joint lined up ready for tacking.

gas at high temperatures. This gas takes up oxygen from the molten metal, thereby actually reducing the oxide content of the steel and improving the quality of the metal in the weld. This is the shielded arc process which has taken the uncertainty out of pipe line welding.

New Process Applied

As welding engineers, contractors and pipe line engineers become more familiar with such new developments, practices in the field are adopted for the application of such new methods. The arc welding procedure and type of joint in common use have been changed to produce a stronger, more ductile and absolutely leakproof joint. The adoption of a joint with a backing-up ring has been the chief change. This joint also differs with the type of line. On gas lines it is standard practice to add a backing-up ring to an ordinary butt joint; however, in oil lines, in order not to increase the resistance of the line, a doube bell joint with backing-up ring is used. In this way the inside diameter of the pipe is kept uniform. Figure 1 shows a common gas pipe line joint and Figure 2 a double bell joint with backing-up ring.

Lining Up the Pipe

Another change in the fabrication of arc welded pipe lines is in the method of lining up the pipe in sections prior to welding. Formerly the pipe was laid directly on skids, as it was not common practice to turn the section during the welding of the stringer bead. Now, however, the section is placed on rollers atop the skids and each joint tack welded so that the entire section may be easily turned during the welding of both the stringer and finishing beads. This procedure, plus the faster flow of metal in the shielded arc process, is responsible for materially speeding up the firing line welding. Figure 3 shows a double bell joint with backing-up ring lined up on rollers ready for tacking.

The number of tack welds applied on each joint depends on the size of the pipe and the number of pipe lengths per section. On large size pipe no less than four tack welds placed equidistant around the circumference of the pipe are generally used. On pipe up to 12 inches in diameter two or three small tack welds are sufficient, except where the sections are unusually long. These tack welds are generally an inch to 2 inches in length. Tacking is done by one operator and a welding machine which moves along the right of way with the line-up gang. Referring back to Figure 3 the method of lining up is shown. In this illustration a slight space between the ends of the pipe

Figure 4—Showing the burning-in bead of a double bell joint with backing-up ring in place.

is evident. This distance is approximately one-quarter inch, which allows the tack welds and burning-in bead to penetrate into the backing-up ring. Tacking is done with one-quarter-inch or five-sixteenths-inch electrodes, depending on the size of the pipe.

After the sections are lined up and

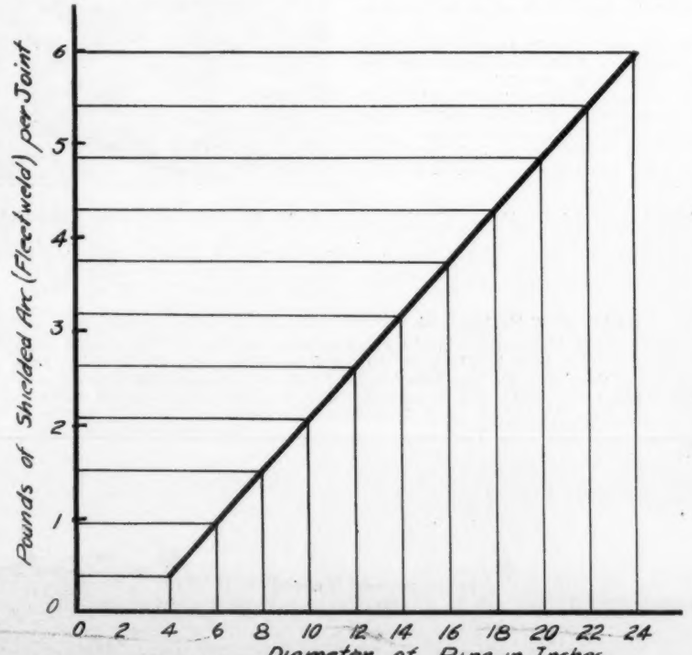

Figure 5—The number of pounds of electrodes per joint increases in direct proportion to the size of the pipe when shielded arc welding is employed.

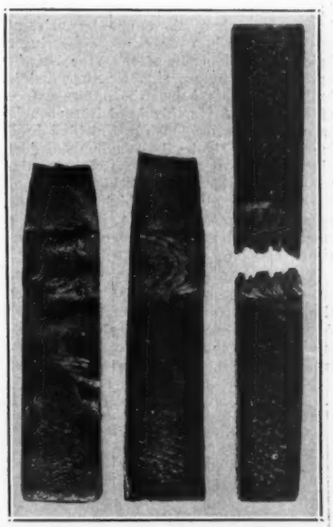

Figure 6—Four holes drilled through the weld metal were necessary to reduce the cross section area of the shielded arc weld in bar on right sufficiently to cause failure in the weld. The pull was 75,000 pounds per square inch. The bars with one and three holes in weld broke in the pipe metal.

tacked, the firing line gang moves into position along the sections to complete the firing line welds. Each unit of a firing line gang consists of one operator, a welding machine and two helpers. The welds are put on in two beads, the stringer bead and the finishing bead. Figure 4 shows a double bell joint with backing-up ring with the stringer bead in place. Referring back to Figure 2 a completed joint of this type is illustrated.

While both the stringer and finishing beads are being applied the pipe is turned continuously by one helper. The welding operator begins at one end and moves along the section applying the burning-in bead as he goes. The second helper follows the operator cleaning the burning-in bead in preparation for the finishing bead. The operator then returns to the first joint and again proceeds along the section finishing each successive joint.

In making rolling welds the electrode is held at right angles to the pipe wall just off the top center on the welder's side, the pipe being rolled away from him. By means of prearranged signals the operator indicates to the helper turning the pipe, to turn faster or slower in order to maintain a speed consistent with the speed of welding. The stringer bead fuses the ends of the pipe lengths and the backing-up ring together and is built up to just below the outer surface of the pipe. After this bead is thoroughly cleaned and scaled, the finishing bead is applied. This bead extends from just above flush to approximately one-sixteenth inch above the outside surface of the pipe, but always is higher than the outside surface. Figure 4 illustrates a completed stringer bead; Figure 2, a completed finishing bead.

The size of electrode to use depends on the size of the pipe and the bevel of the joint. It has been found that a 30 degree bevel is most applicable. The following table shows the proper size electrode to use in welding various sizes of pipe having 30 degree bevel, with the shielded arc:

Diameter—	Size of electrode— Stringer bead	Finish bead
8"	3/16"—1/4"	1/4"
10"	1/4"—5/16"	5/16"
12"	1/4"—5/16"	5/16"
14"	1/4"—5/16"	5/16"
16"	1/4"—5/16"	5/16"—3/8"
18"	1/4"—5/16"	5/16"—3/8"
20"	1/4"—5/16"	5/16"—3/8"
22"	5/16"	5/16"—3/8"
24"	5/16"	5/16"—3/8"

The chart, Figure 5, shows graphically the amount of electrodes in pounds necessary to weld various sizes of joints. As may be seen at a glance, the pounds per joint increase at a constant ratio to the size of the pipe. The values plotted on this chart allow for 15 per cent waste at the end of the electrode. The figures will vary slightly with the weather conditions and the operator using the electrode, but under average conditions with good operators these values are accurate.

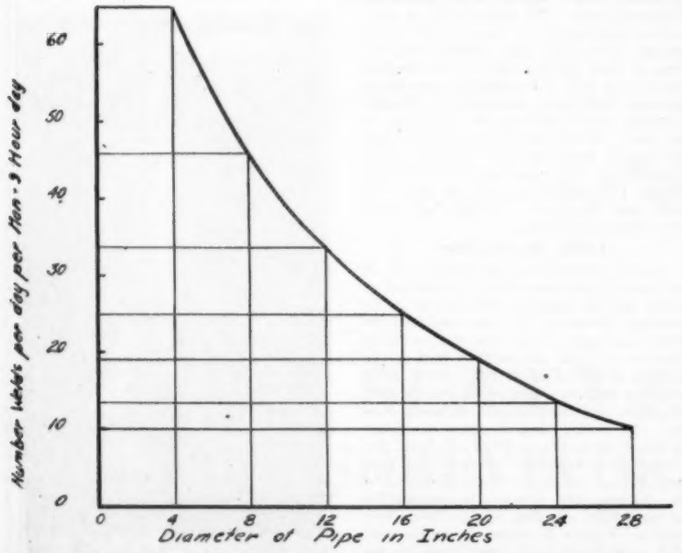

Figure 8—The number of welds per day increases proportionately to the size of the pipe. This chart shows the number of welds per man per nine-hour day on various sizes of pipe.

Welding the Sections

After the sections of the line have been fabricated they are tied into the line by bell-hole gangs. Tie-in welds are generally made in three or more beads. The first bead is started at the top and runs down one side to the bottom center. The opposite side is then welded in like manner. After each successive bead is laid it is thoroughly scaled before applying the next bead. The approximate heats and electrode sizes to use on both firing line and bell hole welds are given in the following table:

Diameter electrode	Roll weld amperes	Bell hole amperes
5/32"	.....	120–150
3/16"	180–225	140–170
1/4"	250–300	
5/16"	350–400	
3/8"	400–500	

Quality of Welds Improved

The greatest improvement in the arc welding of pipe lines has been in the quality of the welds. We have seen how the shielded arc produces a weld free from oxides and nitrides, undesirable in pipe line welds. To be successful the new process must be adaptable to temperature changes and sudden stresses and highly resistant to corrosion.

Modern welding methods can insure a weld with a tensile strength of 60,000 to 80,000 pounds per square inch, depending upon the carbon content of the pipe and metal. Mild rolled steel has a tensile strength of about 50,000 pounds per square inch. A test to show the strength of welds made with the shielded arc is illustrated by Figure 6. The three samples shown were cut from a joint made on pipe having a carbon content of .20 to .30 per cent. The left and middle samples, with one and three holes respectively drilled through the weld metal, broke in the pipe metal. The weld in the sample on the right was reduced in cross section, sufficient to insure failure in the weld by drilling four holes of three-thirty-seconds-inch diameter through the weld metal. This sample broke in the weld at a pull of 75,000 pounds per square inch.

Further proof of the tensile strength of welds made by this new process is demonstrated by tests made on lines now installed or under construction. On a 24-inch line extending from the Texas Panhandle to Chicago, Ill., 756 miles of which were fabricated by shielded arc welding, coupons were cut from the joints of various sections for testing. On one section 291 coupons had an average tensile strength of 66,551 pounds per square inch, on another 126 coupons tested 77,879 pounds per square inch, and on still another 148 welded coupons had an average tensile strength of 76,580 pounds per square inch. On a fourth section the average tensile strength of 150 coupons was 73,575 pounds per square inch. On this line pipe having a carbon content of 0.20 to 0.30 per cent and 0.25 to 0.35 per cent were used. The variations in average tensile strength are due to this difference, the higher tensile strength being secured on pipe having a carbon content of .25 to .35 per cent. These coupons were cut from sections which were welded by the Welding Engineering Co., of Bartlesville, Okla.

Ductility Increased

Ductility of the weld metal is increased by this new fusion process. Figure 7 shows a plain butt joint made in mild low carbon rolled steel and bent with the weld as a pivot to determine the elongation of the weld metal. In this sample the elongation of the outside fibers of the weld metal is 43 per cent.

On one of the above mentioned lines coupons cut from various welded joints were tested to determine ductility. Samples bent in averaged 78 degrees, those bent out averaged 96 degrees. The average bend of welds cut from Section 5 of this line was 89 degrees. Samples from another section bent in averaged 97 degrees, while those bent out showed 120 degrees.

Resists Corrosion

Weld metal created in the shielded arc resists corrosion, in most cases better than the pipe itself. This is obviously a most important factor to be considered, due to the enormous investment in large size and long-distance pipe lines. Thus it is essential that these lines be made corrosion proof as much as possible. In most cases the lines are wrapped and coated before being lowered into the ditch, but even this protection will in time give way to the elements of corrosion. Heretofore, due to the formation of oxides and nitrides in the weld metal, in ordinary welding processes, pipe lines exposed to corrosion have begun to decay in the weld metal more rapidly than in the pipe metal. Now, however, although the welding process under discussion is too new to offer evidence of the resistance of these welds under field conditions, laboratory tests show that shielded arc welds possess higher resistance to corrosion than even the pipe metal.

Effects of corrosion on pipe lines differ with the composition of the pipe metal and the texture and percentage of moisture in the soil through which the

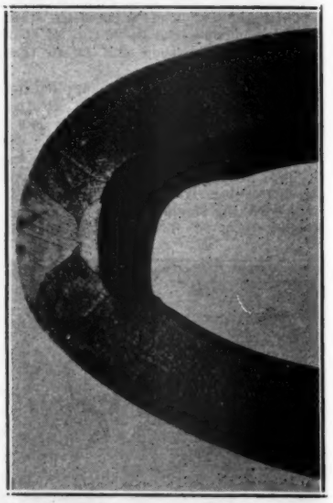

Figure 7—Typical bend test on mild low carbon steel plate to determine the elongation of a shielded arc weld.

Figure 10—View taken along Union-Gulf's pipe line from Mid-Continent to East.

Figure 9—Welding work going on along large natural gas pipe line.

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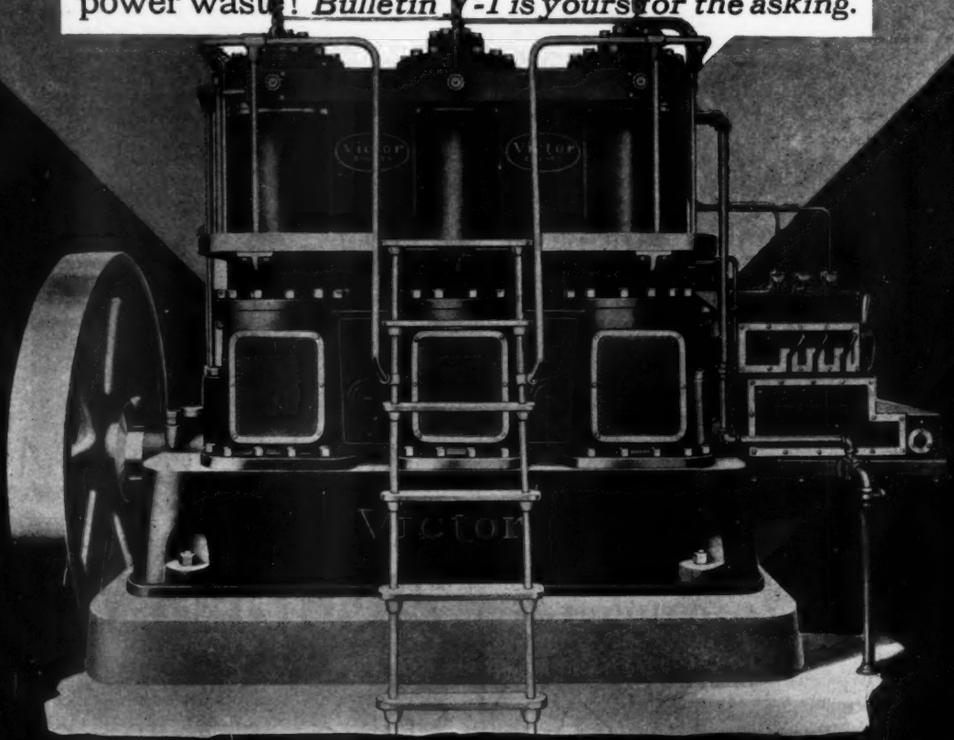


The Power Manufacturing Company, Marion, Ohio

line is laid. The action set up by the chemical differences of the pipe and soil cause rust and corrosion to take place on the walls of the pipe. When this chemical action is slight the pipe will not be affected to any great extent; however, where there is a great deal of moisture corrosion generally takes place rapidly. The oxides in the metal of the pipe wall present an ideal spot for chemical action to begin. In the joints corrosion is eliminated by the shielded arc which prevents oxidation in the weld metal.

Faster welding is obtainable with this modern method. Fabrication with the shielded arc is two or three times as rapid as any other welding process. The chart in Figure 8 shows graphically the production of welds per operator per nine-hour day on various sizes of pipe. The speeds noted are based on the following conditions:

1. No undue loss of welding time by welders due to moving of welding machines or waits for pipe to be lined up.
2. Use of pipe of good weldability.
3. Use of double-bell type of joint with backing-up ring, or equal.
4. Use of pipe in at least 40-foot lengths.
5. Maximum reinforcement of weld approximately one-sixteenth inch.
6. Pipe to be turned on rollers.
7. Cleaning of welds to be done by helpers.
8. All joints to be properly lined up and tack welded ahead of firing line crew.
9. Use of pipe having standard weld thickness.

Under average conditions the actual welding time per joint can be figured as approximately one minute per inch diameter of pipe.

Use of New Process

Since the introduction of this new process of welded pipe line construction it has been, or is being used on a total of 2,754 miles of pipe lines containing approximately 241,352 arc welded joints. These lines, constructed for the transportation of both gas and petroleum products, vary in length and size of pipe.

The rapid rise of this new process of arc welding in pipe line construction has been due solely to the exceptional physical qualities of the welds produced and the speed and economy of its use. Among the lines on which this process is being used is a 24-inch gas line extending from the Texas Panhandle to Chicago, Ill. Firing line welds on 756 miles of this 1,000-mile pipe line are being welded with the shielded arc. When completed there will be approximately 65,000 joints so welded in this line. Figure 9 shows work going forward on this new line.

A 10-inch oil line extending from Perryman, Okla., to the Gulf refineries at Toledo and Cincinnati, Ohio, and Pittsburgh, Pa., is being installed by this process. This line consists of a main line 732 miles long and an 8-inch branch line to Cincinnati, from Dublin, Ind., 51 miles long. A total of 85,888 firing line joints on this line were fabricated by the shielded arc. Figure 10 shows work going forward on this new line.

A 100-mile section of a 20-inch line running from Rockville, Md., into central Virginia will contain about 10,500 joints welded by the new process. The gathering lines constructed near Borger, Tex., by the Texas Interstate Pipe Line Co., were welded by the new process. These lines are composed of 18-inch and 20-inch diameter pipe, 23 miles in length, and have a total of 3,593 welded joints.

A 207-mile, 8-inch line from Darst Creek oil fields in Louisiana to Sour Lake, constructed last year by the Gulf Pipe Line Co., contains approximately 10,560 arc welded firing line joints.

A 32-mile, 20-inch gas line constructed by the Cities Service Gas Co. from Dilworth, Okla., to Wellington, Kans., has 3,478 firing line welds and 752 bell hole welds.

A distribution system under construction in southwestern Louisiana includes 328 miles of pipe ranging in diameter from 4 inches to 14 inches. There are approximately 40,000 welded joints in this system, which is being constructed for the United Gas Co.

An 8-inch line extending south from Powderly, Tex., 14 miles has a total of 2,058 arc welded joints made with the shielded arc.

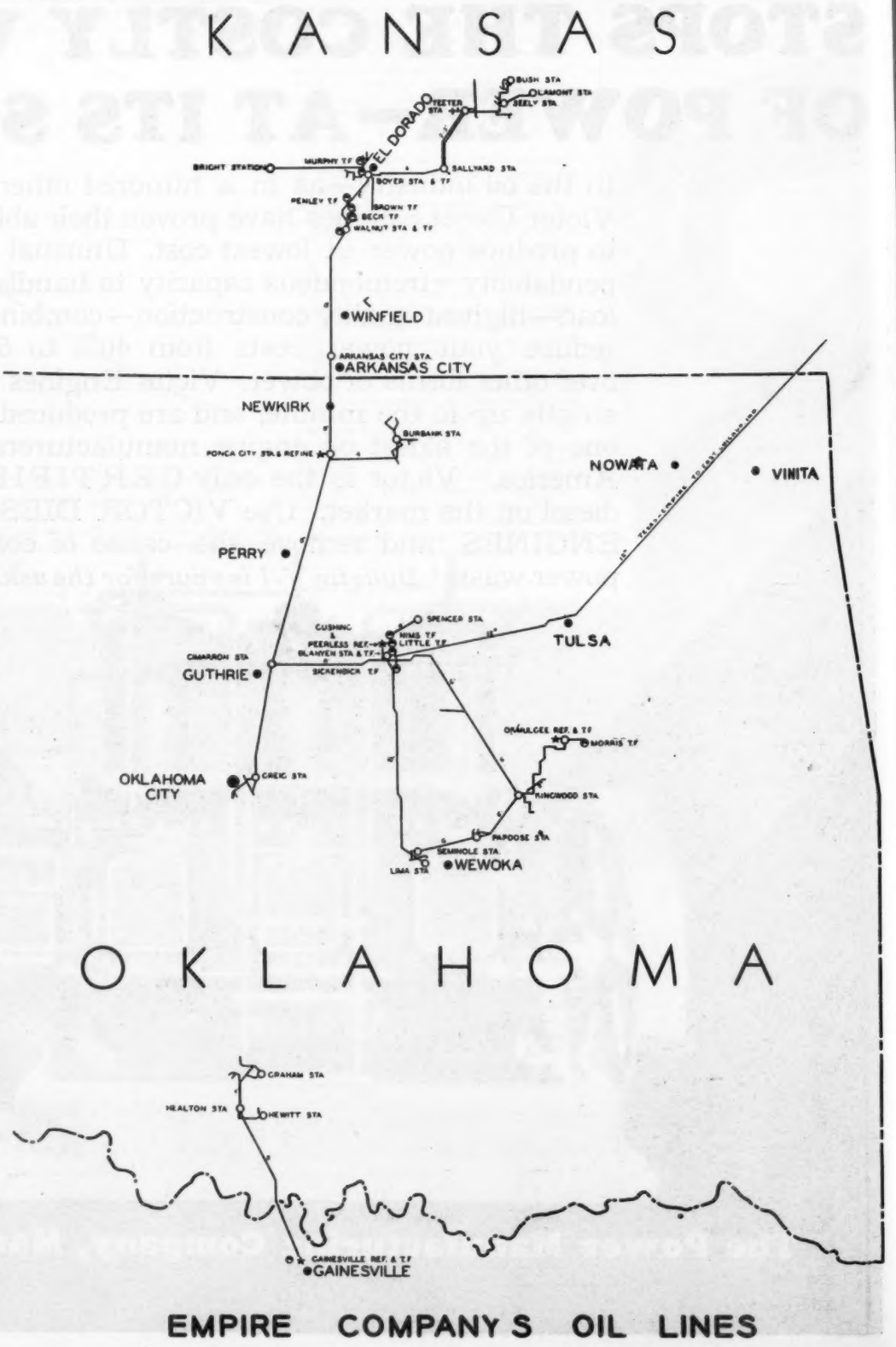
Another system in southern Texas, also being constructed for the United Gas Co., includes 385 miles of pipe ranging in size from 6 to 18 inches in diameter, most of which is being welded.

This new process has also been used on a 57-mile line of 8-inch pipe extending from 18 miles north of Powderly, Tex., to Hugo, Okla. There are 8,379 firing line welds in this line.

Gasoline engine driven welders of high capacity are now being used in most pipe line work inasmuch as better results and greater speeds are obtainable only with higher welding currents. A welder of 300 or 400-ampere capacity N.E.M.A. rating, with the power supplied by a six-cylinder engine, is generally used. These joints are equipped with sheet metal sides and top which may be locked to protect the welder from tampering. The usual method of transportation is to equip the welder with wheels and wagon tongues or carry them along the line on wagons. An automatic idling device, which reduces the speed of the engine when the arc is not in use, will effect economies of fuel consumption. When welding is resumed the engine automatically accelerates to the proper speed.

Pressure Tests

Before putting a pipe line into use it is customary to test both the completed line and its various sections by pressure. In some cases the lines are required to hold the pressure over a period of time while recording gauges register changes in pressure. Allowances must be made for temperature fluctuations when the results are considered. The records at hand on the tests of several completed pipe lines fabricated by the new method show the percentage of leak to be infinitesimal.



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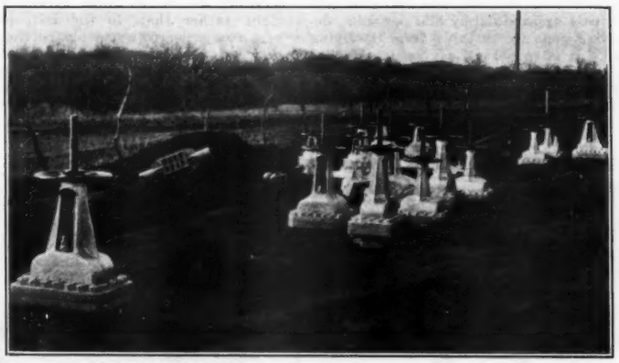

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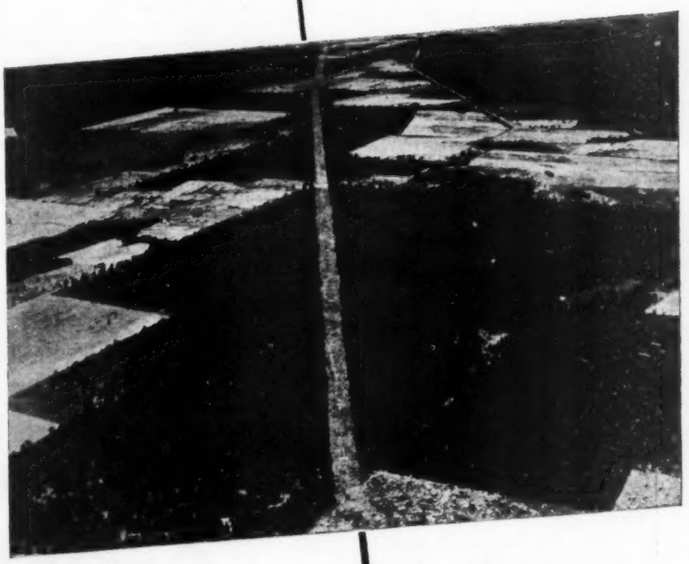

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Aerial Survey for Pipe Line Location

Considerable Savings Effected by Use of This Method Which Results in Shorter Lines. Eliminates Guess Work

By Harry Nelson
Engineering Dept., Empire Companies, Bartlesville, Okla.

The past few years have witnessed the construction of larger, longer, and better pipe lines. Millions are being spent for carriers of natural gas, gasoline, and crude oil; therefore, it follows that better surveying is necessary to keep pace with the larger investments. The airplane and the aerial camera offer the pipe line location engineer a means by which he can easily keep up the pace, do a better job, and at the same time save his company considerable money. One usually associates the idea of added cost along with better quality, but this is one case where the converse of that theory is true.

The convenience and economies of an aerial survey are so obvious that one cannot help but wonder why this method has not come into more general use. Much enthusiasm is manifested by engineers who have tried it, yet there remains a large number of uninitiated who are still too skeptical to recommend such procedure to their superiors. Probably in their own mind they have a suppressed desire to try an aerial survey, but they are unwilling to risk their reputation of good judgment by advising an expenditure for something that might not turn out as they had hoped. The engineer is never thoroughly convinced himself about an aerial survey until he has actually worked with one. From that time on, there is no doubt in his mind, but, until then, the discoursing of others, the viewing of samples, and the reading of literature all fail to remove that last doubt. Only an aerial map of his particular problem can convince him that it is a wise investment to make.

Formerly Needed Extra Men

Heretofore, the construction of a new pipe line of any magnitude necessitated employing additional, and too often, inexperienced engineers for surveying the route. The regular personnel is not large enough to handle the job quickly and pipe lines are not built like roads or other public works—the saying "Must be built and ready for service yesterday"—is indicative of the speed with which pipe line construction is expected to move. It is impossible to employ an engineer who will locate a line as one would locate it himself. One can neither personally supervise a number of field parties nor go over every inch of the right of way on the ground. With an aerial survey, the judgment of inexperienced men is entirely eliminated, additional field personnel is unnecessary, and the engineer can personally supervise the selection of the entire routing without leaving the office.

The largest single factor of economy from an aerial survey is the saving in length. Every foot of unnecessary length means wasted investment which can never earn a return. The longer line earns no more than the shorter one and the operating costs are proportionately higher on the former. For a concrete example, let us assume a 20-inch pipe line 100 miles in length, which will cost approximately $25,000 per mile or $4.74 per foot. An aerial survey for the 100-mile line will cost approximately $50 per mile, depending upon the distance from the flying base. It is conservatively estimated that an ordinary ground survey will be one-half mile longer for each 30 miles, or a difference of 1.66 miles for the 100 miles. At the rate of $25,000 per mile, we have a saving of $41,500 or approximately eight times the cost of an aerial survey.

Aerial Survey Shortens Line

A pipe line located from an aerial map requires no stretching of the imagination to visualize it as a straight line, whereas many pipe lines located by ground methods appear to be going nowhere in particular. Such meandering is usually unnecessary and represents wasted expenditure. The reason for ground surveys being so crooked is quite apparent. Often an inexperienced man is partly responsible, yet on the other hand, years of experience does not vest in him the power of seeing miles ahead and of correlating miles of terrain into a mental picture wherein he can lay out his course. When he encounters an obstruction, he turns an angle to avoid it, never knowing that possibly he should have turned to the right rather than to the left, or vice versa, in order to avoid obstructions farther on. The aerial map eliminates the guess work—the mental picture becomes a reality on paper where the engineer may pore over it with the assurance that his final selection will be correct. He

Reduced photo of portion of a mosaic map. Scale of this reproduction 1.62-inch equals 1 mile.

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fears no criticism on his selection for his map bears mute evidence, and without argument, that his judgment is based on definite reasons.

One might assume that an aerial map is not necessary through a flat country but such is by no means the case. One's first experience with an aerial map proves that farmyards, orchards, school houses, cemeteries and other improvements cause more deviation from a straight line than does rough topography. The seriousness of their large number is not realized until an attempt is made to lay out a straight line to miss them all. In rough country the improvements are few and the best routing is quite apparent after a little study, whereas considerable time is necessary to lay out the shortest line that will clear all improvements.

Second in importance to the saving in length, is the saving occasioned by avoiding objectionable topographical features. Quite often rock outcrops are plainly visible on the photographic map. By avoiding a few ravines, canyons, stream crossings, and unnecessary pipe bends, the cost of the aerial survey is saved easily several times.

Saving to Contractor

If the pipe line is to be contracted, we have the possibility of a saving in the contractor's bid. With a photostatic copy of the map, the contractor can go over the ground intelligently and without getting lost. If his frame of mind at the end of his trip has any connection with his bid, his price should be appreciably lower than ordinary. At any rate, he does not have to "shoot the moon" or allow a little extra for the portion he cannot see. Every trail and road is known for estimating stringing and transportation costs. No stream crossing need be exaggerated for safety's sake. He knows where to expect rock, caving ditch, or "good going," and if such knowledge is instrumental in shaving the amount of his bid a fraction of 1 per cent, the aerial map will have paid for itself.

Undoubtedly, the man who buys rights of way, with a photostatic copy of the aerial map as an aid, can save weary hours of conversation and many rash promises. Any farmer immediately becomes interested when shown a picture of his farm. It is logical to assume that a certain psychological effect is produced, making him easier of approach. He knows nothing of the project until the right of way man comes to buy the easement, for no surveyor has heralded the news by trampling down his crops nor aroused his ire by letting the cows out through a broken fence. The right of way can be purchased without the driving of a single stake. The landowners have no opportunity to get their heads together relative to the price they will demand of the "big corporation."

Advantages of the aerial survey can be enumerated by the score. That it is a valuable record for reference during future operation of the line, for the selection of station sites, main line gate locations, farm taps, and meter sites, is unquestioned. The engineer readily admits the advantage of such conveniences, but after all convenience is secondary to cost. Convenience alone does not justify the cost so naturally he wishes to know if the expenditure will pay a dividend. That the aerial survey pays a handsome dividend is quite apparent to the engineer who uses it but he is at loss to prove it. He cannot say he has saved so many feet of line, eliminated so many bends or saved so many yards of excavation. He knows the saving is there but he cannot point it out specifically nor set it up in dollars and cents. Unless the same line is surveyed by both methods, there is nothing to which he can compare.

One Example Cited

The writer had occasion to be connected with the aerial survey of a line, 20 miles of which had previously been surveyed by the ground method. The ground survey had been made by an experienced surveyor, and incidentally except for numerous jogs around houses and other obstructions, followed an east and west section line for a major portion of the 20 miles. It was considered a very good survey and in as much as it paralleled a section line most of the way, it was supposedly as short as possible to make it. The routing chosen from the aerial map at no place coincided with the previous ground survey and was well over a mile shorter. The section line itself was upon examination of the aerial map, far too crooked to follow with a large pipe line. Over two weeks had been spent by the ground party locating the 20 miles of line whereas only a few hours were necessary with the aerial map.

As previously mentioned, the question of speed is of prime importance. A ground location survey can get under way occasionally more quickly, but the finished job is completed by means of the aerial map in a fraction of the usual time. Cloudless days are necessary for photographic flights, but one clear day means approximately 75 miles of double strip map, which is enough to keep things going until the weather man sees fit to allow another clear day.

There are many kinds of aerial surveys and their cost depends largely upon the accuracy required and the amount of ground control. Fortunately, the class of aerial survey suitable for pipe line location requires no ground control other than a few markers and extreme accuracy is unnecessary. An experienced photographic crew can produce a map that will scale within 1 or 2 per cent, which is ordinarily close enough for most scaling. A 450-mile line recently mapped, scaled within 1 per cent of the actual chained distance. The pipe line engineer is more interested in correct alignment than accurate scale—that is, a straight line on the map must be a straight line on the ground. There are several methods of alignment control, but before awarding a contract to an aerial mapping company it is well to have a definite understanding as to just how the alignment shall be controlled during the assembly of the map. If the contract is given to a company of considerable experience in making maps for pipe lines, one should have no trouble, and the delivered map will produce entire satisfaction even though it may have cost a fraction more than if done by a new inexperienced concern.

Making Aerial Maps

In order that the engineer may satisfy himself that he is photographing the proper routing, he should accompany the photographic crew over the proposed line on a reconnaissance flight. He may have more than one route in mind and since the strip to be photographed is nearly 3 miles wide, he need only choose which 3-mile strip is best. All detail of location is left until the finished map is available. After the reconnaissance flight, markers may be placed on the ground for the guidance of the photographic flight. Markers are usually placed at intervals of 10 to 15 miles. A cross with panels, 100'x6' make excellent markers, and will show plainly on the photographs. They may be made of cheap cloth or lime, the latter being easier to use and by far the more economical.

The usual aerial map for pipe line location consists of a double strip of photographs at a scale of 1,000 feet to the inch, covering a width of 15,000 feet or about 3 miles. Exposures are made at an altitude of 12,000 feet plus the sea level elevation of the area to be mapped, at which altitude a camera whose focal length is 12 inches produces a picture at the desired scale. No enlargement is required. Each exposure overlaps the preceding one by 60 per cent and the adjacent strips overlap by 25 to 30 per cent. Only the central portion of each picture is true to scale, therefore, in the assembly of the map, the edges are trimmed off and discarded.

It is not necessary to give a detailed description of the aerial camera and the method of developing the special film. The camera is essentially similar in principle to an ordinary kodak and the developing and printing processes are also similar. Special equipment is necessary for handling the long film. Prints are made on semimatte paper to go into the mosaic assembly and usually glossy prints are preferred for the contact prints. By "contact prints," we mean a print of each individual negative to be used by the engineer in conjunction with the mosaic for stereoscopic study.

The stereoscope is a simple contrivance that, although different in appearance from the one which graced the parlor of our boyhood days, is identical in application. By means of a system of mirrors, the observer views two of the overlapping contact prints, which are in reality two pictures of the same area but taken from a slightly different angle. The result is that the observer actually sees a given point from two different angles, or in other words, the interval between the observer's eyes is transformed from a few inches to several hundred feet which enables him to see the area in all its relief. Another example, is that the observer sees a hill from both sides at the same time—one eye sees the hill from the point at which exposure No. 1 is made and the other eye sees it from a point several hundred feet re-

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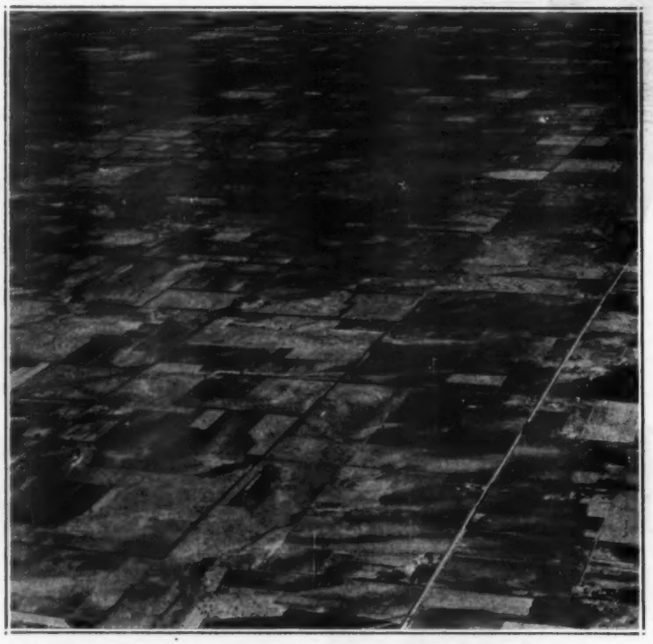
moved where exposure No. 2 was taken. Persons who have the use of but one eye cannot perceive relief from the stereoscope. It is not an optical illusion, but a scientific means of interpreting the aerial photograph and without which the aerial map would be of little value.

Interpreting the Map

With a little experience the engineer soon becomes adept at interpreting the aerial photograph. Rock outcrops are distinguished by the contour-like outlines, overflow areas of streams are readily traced by slight soil discolorations, well traveled roads are lighter in color than unfrequented trails, cultivated fields are identified by the turn-rows of the plow, orchards are identified by the tree rows and even a barbwire fence line stands out boldly, all of which merely goes to show the wealth of detail it is possible to determine from the aerial photograph.

The mosaic assembly is usually mounted on cloth so that it may be rolled up and filed away. It is advisable to have the sections as long as can be conveniently handled. Twenty-five-foot sections are a convenient length, or representing approximately 50 miles of line. By stretching a string between objective points and shifting in between to avoid obstructions and objectionable topography, the shortest and best route is quickly and easily determined. The entire route thus selected is checked on the contact prints under the stereoscope. The routing is ruled on with black india ink, and after such information as section, township and range numbers, highway numbers, stream names, town names, railroad names, etc., are added, the map is ready for copying.

An aerial map to serve its full value must be available for field use. The writer and associates, conceived the idea of making photostatic copies for the use of the contractor, right of way buyers, and the staking parties. Although the photostat loses considerable photographic detail and sharpness, enough remained to serve the purpose well. The mosaic was photostated in sections full scale, each photostat overlapping the preceding one an inch. A mask was made for a border in a corner of which was a hole to permit an alphabetical index to show. Two negative photostats were made and to one was added landowners' names, property lines, and the number of rods across each tract. From the negatives as many positive copies could be made as are necessary. The right of way buyers used the copy showing ownerships and roddages, whereas the staking party, contractor, and executives on inspection trips used the other. The positive photostats were bound up in booklets with a county index map showing the geographical location of each photostat, each booklet covering about 50 miles or one 25-foot section of the original mosaic map. Such procedure proved very convenient and satisfactory for field use.



An oblique view of area in southern Kansas.

Calculating Distances

In order to calculate the number of rods across each tract a table of conversion factors was prepared to correct any variance in scale. Except in the northern and western tiers of a township, each mile was assumed to be 5,280 feet. If a certain mile scaled 5,200 feet, the scale reading across any tract within the section is multiplied by the table factor of 1.0154 which gives the true distance in feet. To convert the same scaled distance to rods, multiply the scale reading by the tabular factor .061539. Thus the right of way man is able to purchase easements at the customary price per rod.

The above procedure does not hold for areas that are not sectionized such as the greater portion of the State of Texas. In such areas, one must accept the scaled distances as being near enough to correct for buying of easements, or obtain the approximate scale of the map from known distances at frequent intervals. However, bargaining for right of way never reaches such a fine point that a rod or two error makes any appreciable difference. The errors are likely to be of a compensating nature; therefore, if the aerial map is of good quality the scaled distances can be used safely.

In conclusion, it might be well to mention some of the minor details that go to make the mosaic map more convenient to use. Before the finished mosaic is removed from the assembly table, a string should be stretched across the center line and points marked under the string at intervals of 18 inches. The map will have a tendency to warp out of line as atmospheric conditions change, but with the center line points as a guide, it can be thumb-tacked down to its original shape. If the index numbers of the individual photographs are marked on with a light blue ink, they will show dimly on the photostatic copies and not be confusing with the other data, yet will show plainly enough to be legible. The index numbers of the contact prints should appear on the face of the print along the edge or in a corner. If the numbers are on the back instead of on the face, it is confusing when a large number are to be examined under the stereoscope. The finished mosaic should be trimmed so that both edges are straight and parallel, in order to minimize warping when rolled and stood on end.

MAP OF PIPE LINE SYSTEM OF COLUMBIA GAS & ELECTRIC CORP.

Odorization of Natural Gas Effective

Gives Warning Which May Prevent Loss of Life and Property and Results in Considerable Saving by Stopping Leakage

By R. L. Hamilton and J. T. Rutherford
Standard Oil Co. of California

Natural gas as produced in most localities is odorless, particularly when diluted with air to explosive concentrations. Several explosions have occurred from leakage in the distribution of natural gas, resulting in the loss of life and property, which might have been prevented had the gas possessed a characteristic odor. Other gases, especially blue water gas, are dangerous because of their poisonous nature, due to the high content of carbon monoxide. Leaks in pipes, although apparent by distribution losses, are difficult to find and may amount to large sums. The addition of odor to gas will not only reduce losses for the distributor, but will provide safety from explosive and asphyxiative hazards for the consumer.

Odorization of domestic fuel gas has been a subject of considerable study and experimentation for the past several years, but prior to 1928 practical uses of odorants were limited by the high cost of the odorizing materials. With the development in 1928 by the Standard Oil Co. of California of Calodorant No. 3, the field of odorization has grown very rapidly.

A satisfactory odorant must have a distinct and penetrating odor. Odors that are not especially disagreeable or which are characteristic fo preparations used in cooking are not satisfactory warning agents. An odor which will be unmistakably detected as gas is required; and where manufactured gas has been used, a similar odor is desirable. It must be nontoxic, noncorrosive, insoluble in water, and must burn to harmless and odorless products. Central odorizing stations on high pressure lines require a volatile product, which will completely vaporize at a rate satisfactory for odorization. Practically all odorizing agents used in the past were impractical due either to high odorizing costs or unsatisfactory odor.

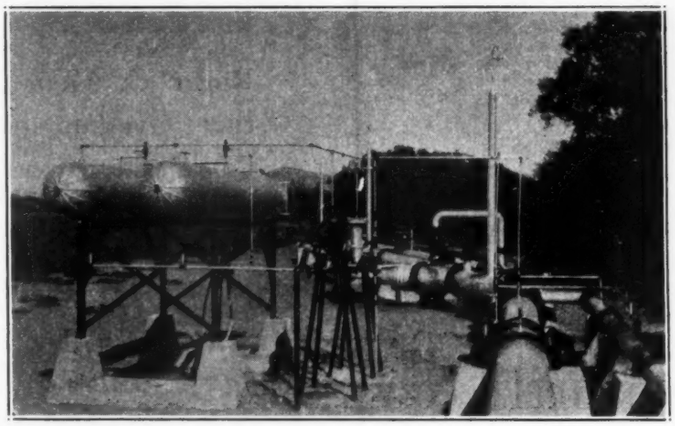
Development of Odorant

The research department of the Standard Oil Co. of California was requested to investigate the possibilities of supplying a product suitable for odorizing natural gas. The first product manufactured was submitted to the gas companies for trial, and was found to possess the desired odor; but was unsatisfactory for odorization at high pressures, because of a tendency to condense and drop out in the lines.

Calodorant No. 3, which is a more volatile product, meets all requirements of a gas odorant. It has a distinct and penetrating odor very similar to manufactured gas. It is nontoxic and noncorrosive. As the odorant will always be present in the vapor phase, it has no effect on diaphragms and gaskets, and remains inedfinitely dissipated throughout the gas. It adds no harmful or odorous products of combustion to gas.

To determine volatility requirements under any condition of temperature and pressure, the work was directed toward the establishment of a relationship between volatility and A.S.T.M. distillation, because of the convenience for practical purposes of such a generalization for stocks having a wide range of boiling points.

Calodorant No. 3 is not a pure compound of a constant boiling point, but a complex mixture of organic compounds of different boiling points. The volatility, expressed as the quantity that will completely vaporize under definite conditions of temperature and pressure, is determined by the equilibrium vapor pressure. The equilibrium vapor pressure is the maximum pressure in pounds absolute at which all components of the mixture are completely vaporized, and not the vapor pressure exerted by the light fractions commonly referred to in speaking of gasoline.



Atomizing odorizer at San Pablo Junction near Richmond, Calif. The gas flowing through the station varies from practically nothing to as much as 50,000,000 cubic feet per day.

Apparatus Developed

An apparatus was developed whereby the equilibrium vapor pressure was determined by measuring the air-odorant mixture that gave a dewpoint at atmospheric temperatures. This apparatus, with the exception of pressure, simulated actual odorizing conditions. A diagrammatic sketch of the apparatus is shown in Figure No. 1. The odorant to be tested was fed at a constant rate from a graduated cylinder into the top of a 30-inch, chain-packed glass column, 2 inches in diameter. The rate was maintained by the flow of water into the graduated cylinder, displacing the odorant. The air was fed through an orifice meter to the bottom of the column countercurrent to the odorant. The vaporized odorant and air mixture was discharged from the top of the column into the first drop out bottle, and thence, through a cooler, into a second drop out bottle. Liquid in the first drop out bottle indicated too high an air rate, with odorant mechanically carried over. Condensate in the second drop out bottle, with a few degrees drop in temperature, indicated that the air from the column was saturated with odorant. The air rate was adjusted to maintain a constant height of packing wetted by odorant. The tests were run for six hours to definitely establish equilibrium conditions within the column. The equilibrium vapor pressure was then calculated from the air odorant ratio.

A typical example of such a calculation is as follows:

Odorant: Specific gravity, .813. Molecular weight, 118. Equilibrium established at: Temperature, 60° F.

Odorant rate, 1.61 cc. per minute.

Air rate, 9.70 cubic feet per minute.

Equivalent cubic feet per gallon of odorant vapor at 60° F. and 14.7 pounds per square inch.

$$= \frac{359}{118} \times \frac{460 + 60}{492} \times .813 \times 8.33 = 22.3 \text{ cu. ft.}$$

Since there are 3,785 cc. per gallon, this equals

$$\frac{1.61}{3,785} = .000425 \text{ gals. per min. of odorant fed}$$

$= .000425 \times 22.3 = .00948$ cubic foot per minute of odorant vapor.

The mol fraction of odorant is the number of cubic feet of odorant divided by the total cubic feet of mixture.

Equilibrium vapor pressure at 60° F. $= \frac{.00948}{9.70} \times 14.7 = .0144$ pound per square inch.

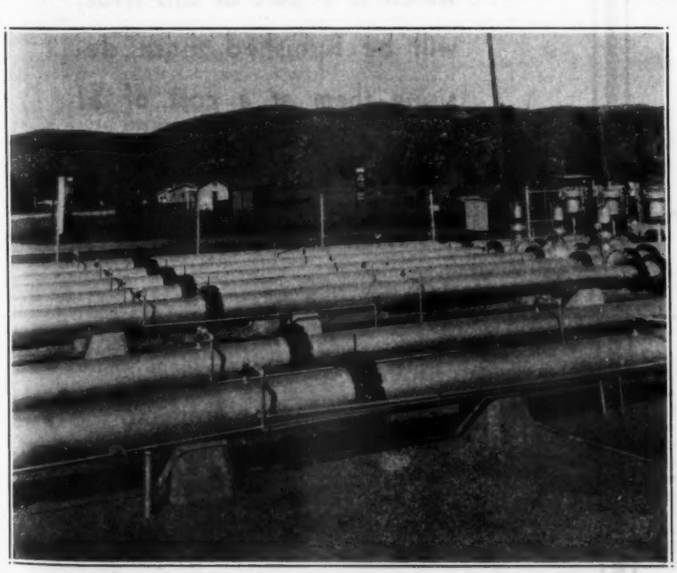
Volatility at 250 pounds per square inch and 60° F.

$$= \frac{.0144}{(250 + 15)} \times 1,000,000 = 54.4 \text{ cu. ft. odorant vapor or } \frac{54.4}{22.3} = 2.44 \text{ gallons per 1,000,000 cubic feet of gas.}$$

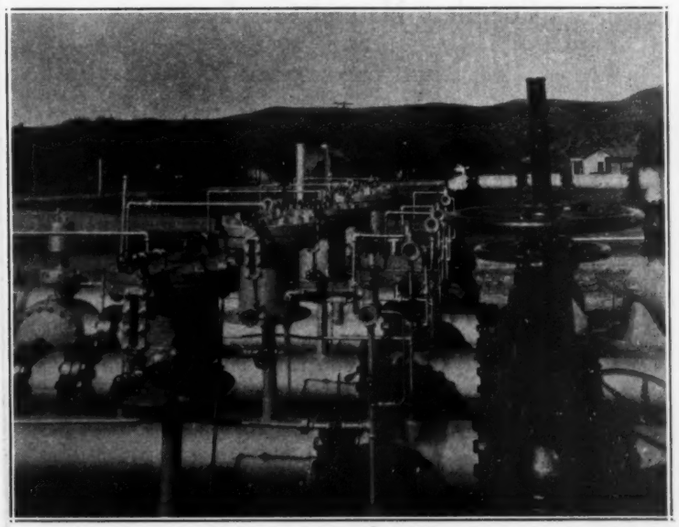
The normal dewpoint was determined on a few representative stocks to establish the equilibrium vapor pressure-temperature relationship.

A relationship was established between the A.S.T.M. distillation and equilibrium vapor pressure for stocks having widely different boiling points. From this relationship it was possible to determine the A.S.T.M. distillation necessary for the desired volatility requirements.

Odor: For satisfactory odorization, the



A central odorizing station some 40 miles from the center of Los Angeles. The peak gas load is over 100,000,000 cubic feet per day.



A battery of odorant injectors on the high pressure gas lines near Newhall, Calif.

STOPPERS SINCE 1897

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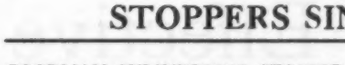

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The Oil and Gas Journal
TULSA, OKLAHOMA

volatility must at least be sufficient to allow complete vaporization of the quantity required to produce the desired intensity of odor. For determining the amount of odorant required, a measured sample of the equilibrium air-odorant mixture, obtained in determining vapor pressure, was diluted with a measured volume of air to the desired intensity of odor. The apparatus used is shown in Figure No. 1. The apparatus is essentially the same as that used by the Bureau of Mines, with the exception of the vaporizer. The rate of odorization determined by loss in weight when bubbling air through an odorant is only applicable to a substance having a constant boiling point. Such a method, if used on a complex mixture of compounds of various boiling points, would first vaporize the light fractions at a gradually decreasing rate. These would not be representative of the entire substance.

In comparing odorants by smelling from a bottle, the most volatile product will often appear to have a higher odorizing value which may not be true. It is felt that the results obtained on the odorometer are fairly reliable and representative of commercial requirements. However, it is recognized that there is a large personal factor involved in determining the relative intensity of odor.

For comparative purposes tests were made on pure sulphur compounds and other odorizing agents. In Table No. 1 are shown the results of the tests:

TABLE NO. 1—COMPARATIVE TESTS WITH VARIOUS ODORANTS FOR NATURAL GAS

Odorizing agent—	Odorizing rate gals./mm. cu. ft. for satisfactory odorization	Remarks
Calodorant No. 3	2.0	
Pyridine	5.0	Toxic
Amyl acetate	2.9	Odor not satisfactory also an irritant at higher concentrations
Croton aldehyde	4.0	
Ethyl mercaptan	.25	
N-propyl mercaptan	.25	
Isopropyl mercaptan	1.25	
N-butyl mercaptan	.50	
Ethyl sulphide	1.75	
Butyl sulphide	1.50	
Isoamyl disulphide	5.0	

Calodorant No. 3 is a dark amber colored liquid, free from water and solid material, having approximately the following physical and chemical properties:

Gravity	42° A.P.I.
Flash	Below 70° F.
Fire	Below 70° F.
Acidity	None
H_2S	None

A.S.T.M. Distillation

Initial	110° F.
20%	250° F.
50%	320° F.
90%	380° F.
Endpoint 98%	430° F.

Molecular weight 120
Sulphur content 4.5%

The product possesses its characteristic odor by reason of various sulphur compounds which are present in the following relative quantities:

Odorous compounds—	% ttl. sulphur
Mercaptans	3
Sulphides	74
Disulphides	12
Nonodorous compounds	11
Total	100

The most important sulphide sulphur compounds present in the product have been isolated and identified. At an odorizing rate of 3 gallons per 1,000,000 feet, the sulphur content added as odorant will be negligible, amounting to less than one grain per 100 feet of gas. None of these sulphur compounds will decompose to give the gas a poistive reaction for hydrogen sulphide.

Methods of Injection

Economical odorization, of course, requires that for a reasonable capital outlay, odorizing stations can be maintained at central locations which, in some instances, are several miles from the place of distribution. It is also necessary that the injecting device automatically maintain the desired proportion of odorant, regardless of fluctuations in the operating conditions of the gas line. Calodorant No. 3 is well adapted to centralized odorisation, because it will carry indefinitely in the gas at high pressures, remaining completely vaporized and diffused at all times.

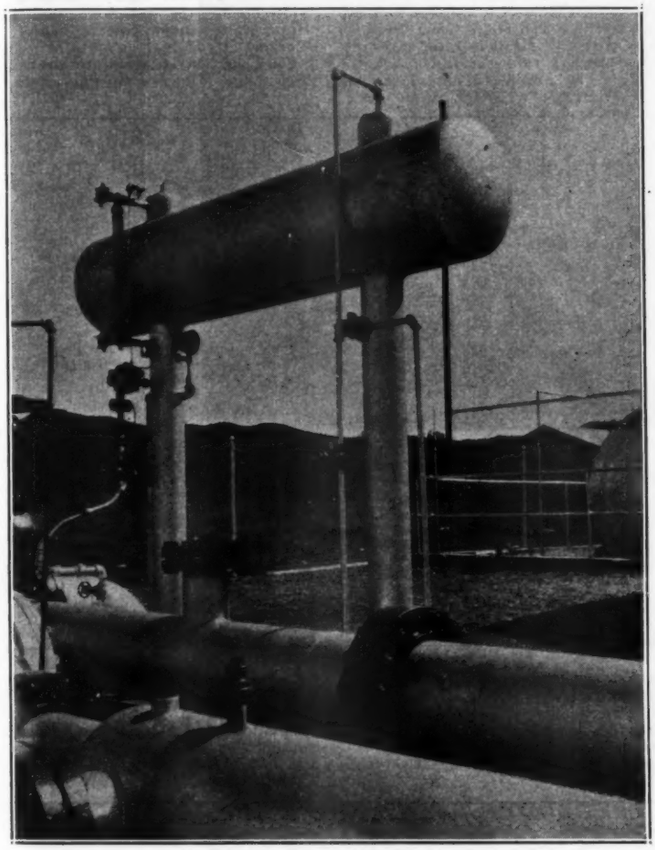
During the past three years, many automatic odorant injecting devices have been constructed. A few have been successful, but the most have either become obsolete or have been definitely discarded. Most of the successful devices have regulated the flow of odorant oil by the differential pressure existing between the upstream side and the downstream side of an orifice installation. One of the first successful installations was that of the Southern Counties Gas Co. at Ventura, Calif., introducing Calodorant No. 1 liquid into a line carrying natural gas at 250 pounds pressure. Essentially, the device consisted of a small orifice, through which the liquid odorant passed into the gas stream, connected in parallel with an orifice in the gas line in such a way that the differential pressure across the liquid orifice was always the same as the differential pressure across the gas orifice. By the use of this principle, the odorant was proportioned in a constant ratio to the amount of gas flowing. This measured amount of liquid flowed into the top of rock filled tower, through which the gas passed in a counter direction. The tower served to increase the area of evaporation and to aid complete dispersion of odorant liquid. With the later development by the Standard Oil Co. of California of the more volatile Calodorant No. 3, the rock tower was not used, as it was no longer necessary.

Reflect Engineering Skill

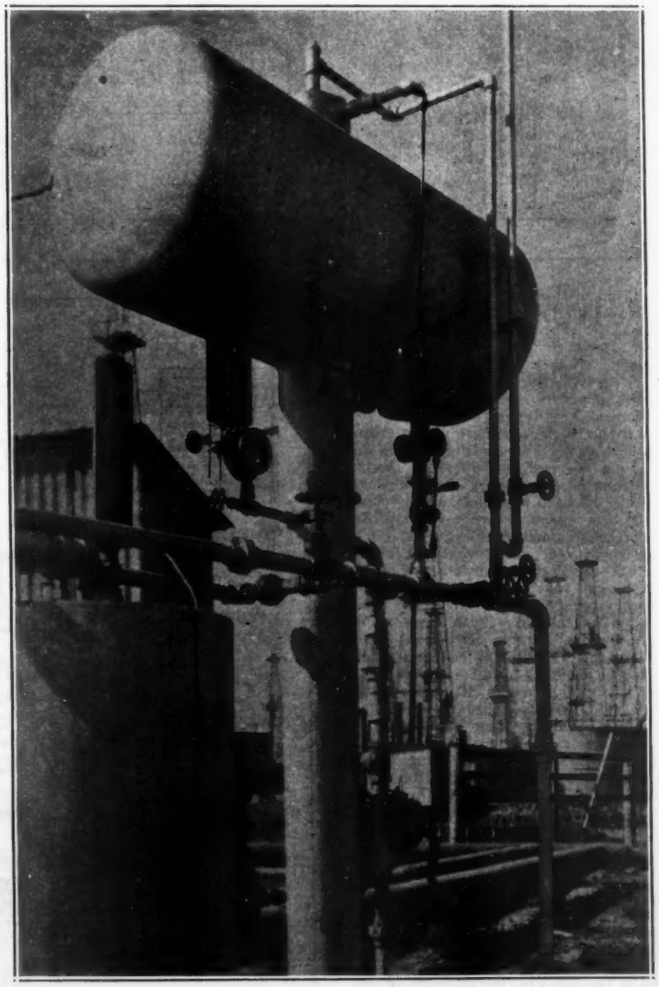
Following the success of the apparatus of Southern Counties Gas Co., several devices were constructed by various other companies. Those intended for very small gas flows are semiautomatic, and are of simple construction. Others, intended for odorization of large volumes of gas, reflect considerable engineering skill in their design. The Pacific Gas & Electric Co. of San Francisco has built an elaborate apparatus, using a Venturi tube instead of an orifice to obtain a differential pressure with which to proportion the amount of odorant. The high velocity of the gas in the throat of the tube is used for atomization of the odorant. A diagrammatic sketch of the apparatus is shown in Figure 2. A standard form of Venturi tube made from thin gauge metal, is installed inside a section of pipe, which is connected into the gas line by means of Dresser couplings. The odorant is introduced at the throat of the tube through the nozzle pipe as nidicated in the diagram. The apparatus is equipped with approved types of oil strainers, regulators, constant level floats, and storage tanks.

In the Venturi tube, as in the orifice meter, the gas flow is proportional to the differential pressure only so long as the static pressure is constant. In ordinary city distribution lines the static pressure varies only slightly over a long period of time. However, in some high pressure transmission lines, the static pressure may vary over a range of 50 per cent. Consequently, in the Pacific Gas & Electric apparatus, adjustment for proportioning the odorant with changes in the static pressure of the gas is obtained by a series of orifice plates for measuring the liquid. The orifices are automatically cut on or off as the pressure increases or decreases. For instance, if the static pressure is 250 pounds, one orifice is in use. If the static pressure increases to 275 pounds, a regulator automatically cuts in another orifice, and then two are in use. If the pressure increases sufficiently, the third orifice is cut in.

Quite recently, the Pacific Pipe & Supply Co. of Los Angeles placed on the market complete equipment for odorizing natural gas. The system, known as the H and K. Odorizer, was developed with co-operation of the engineers from several gas companies, and is now almost universally used in Southern California.



Typical H & K odorizing station. The 12,000-gallon storage tank is partially shown on the extreme right of the picture.



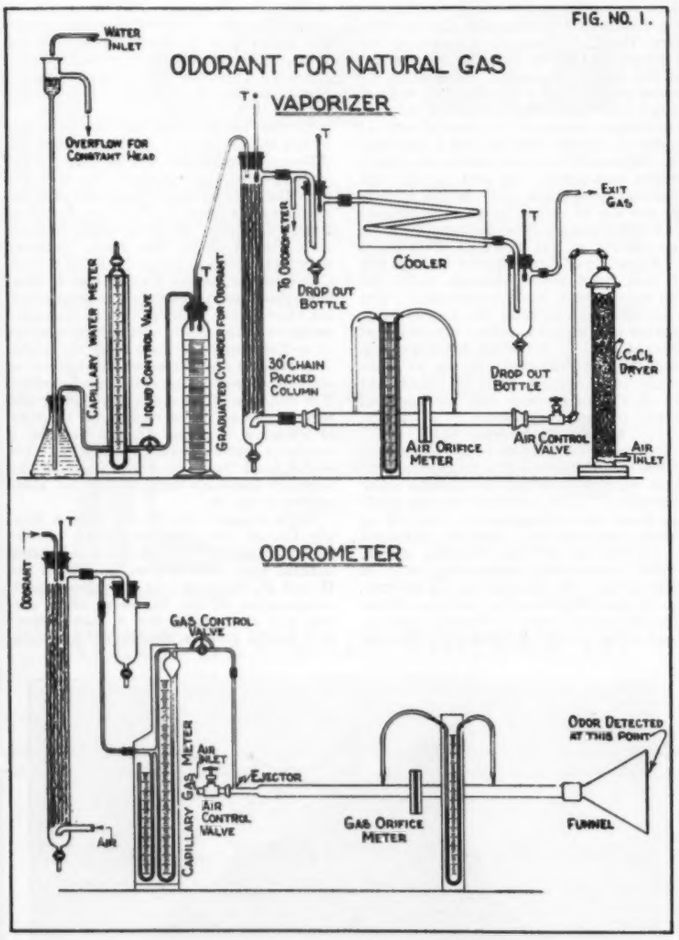
Odorant station on the gas line from Playa Del Rey Field near Venice, Calif.

It is designed especially for use with Calodorant No. 3, the commercial product of Standard Oil Co. of California. The device is fully automatic, of simple design, and relatively inexpensive. A diagrammatic sketch of the apparatus is shown in Figure 3.

The differential pressure of the gas across an orifice is used for the proportioning of the liquid odorant in the same manner as in previously described systems. However, the odorant orifice, float chamber, strainers, and peep sight feed are all in one compact unit. On placing the equipment in operation, the odorant is pumped or transferred into the run tank from the storage container by means of a blow case. For small plants the run tank can be used for storage. During this filling process, the run tank is usually closed off from the gas line and vented to the atmosphere. However, when the odorizing equipment is located in a district where vent gases would be objectionable, the liquid can be transferred into the run tank by providing pumping equipment which will operate against the existing line pressure. In any event, when the run tank is filled and under line pressure, the liquid odorant gravitates into the float chamber immediately below the tank. In this chamber a small orifice is constructed, through which the liquid passes into the peep sight and then into the gas line. Since the same differential pressure exists across the orifice for the liquid as exists across the large orifice for gas, it is evident that (disregarding changes in static pressures) any change of the quantity of gas flowing will cause a corresponding change in the flow of liquid. The odorant enters the gas line on the downstream side of the orifice; where, because of the volatility of Odorant No. 3, immediate vaporization and diffusion takes place.

In most transmission lines it is necessary occasionally to change the orifice plate in the gas line, for purposes of accurate measurement on account of changes in average flow conditions. In order to eliminate the necessity of a corresponding change of the orifice for the odorant, the H and K Odorizer is provided with a differential pressure by-pass, as shown on the diagram. The manufacturers claim that the by-pass valves can be regulated, when the plant is started, so that only a portion of total differential pressure is acting upon the orifice for the liquid. Consequently, when a change of gas line orifice plates is made, it is only necessary to either slightly close or open the by-pass valve until the proper amount of odorant is flowing. This is determined by means of the small calibrating tube, which is immediately below the float chamber. The by-pass valve can also be used to make adjustments for changes in static pressures, such as may occur when line pressures are arbitrarily increased or decreased in the course of line operation.

FIG. NO. 1.



Quantities to Be Used

The quantity of Calodorant No. 3 to be used per 1,000,000 feet of gas depends almost entirely upon the degree of odorization desired. At the present time it is the common practice to use 2½ to 4 gallons per 1,000,000 feet. Some users believe that the 4-gallon ratio gives detectable odors to leaks which are too small to be considered hazardous, and which do not waste sufficient gas to warrant the cost of repairing.

For introduction of odorant into a new district, a logical procedure is to start with a low odorant-gas ratio, for example, 1 or 1½ gallons per 1,000,000 feet. This amount is then gradually increased to the point where the desired results are obtained. There are several advantages to this procedure.

1. The repair crew is not overburdened with leak complaints at the very start of the program.

2. The good will of the consumer is not strained by long delays in repairing leaks, or by prolonged exposure to unusual odors.

3. Accurate data can be collected to determine the correct amount to use for the desired result.

The cost of odorization depends on the location of the plant, quantity of odorant used, the amount of gas treated, plant operating costs, and fixed charges. Consequently, no cost figure can be given which would be generally applicable. However, the major cost is that of the odorant.

Some additional expenditures are caused by handling leakage complaints which invariably increase in number after odorization is adopted. Offsetting these costs are the savings effected by discovery and elimination of leaks, and the very substantial advantage of decreased hazard both to property and human life.

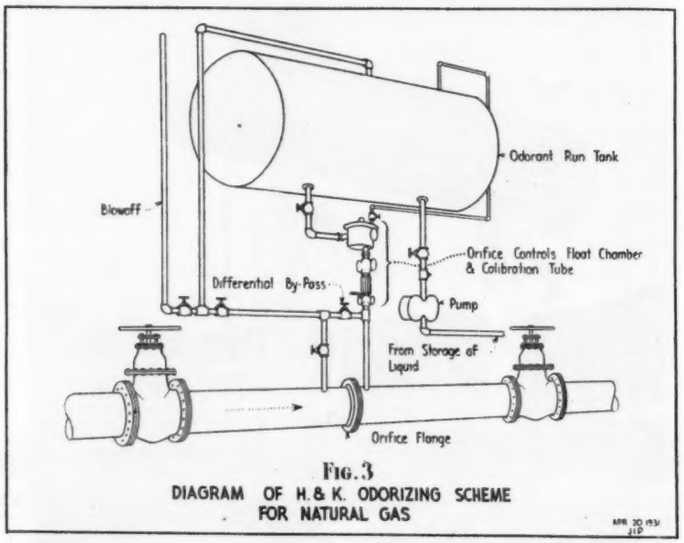


FIG. 3
DIAGRAM OF H. & K. ODORIZING SCHEME FOR NATURAL GAS

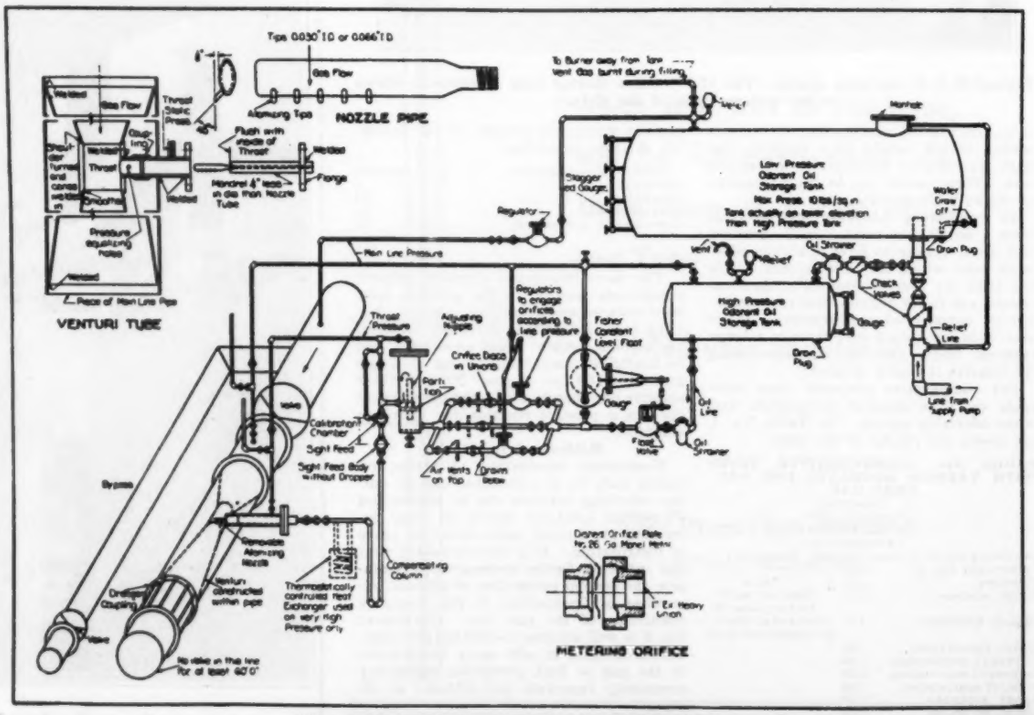
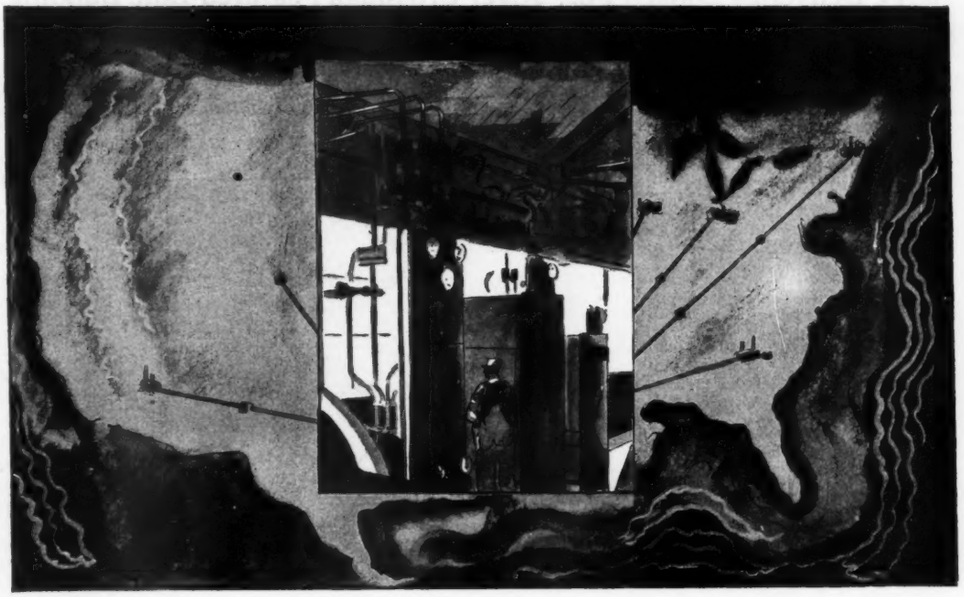


Figure 2—General arrangement of atomizing odorizer.



PULSING OIL

ACROSS A CONTINENT

NO BARRIER is too great where the needs of industry are concerned. Force created in relentless turbo-generators keeps oil pulsing across the continent, over mountains, beneath rivers, through swamps . . . . that the wheels of industry may turn. Pipe lines reach north to Parco, Wyoming; south to Gulf Coast cities in Texas; and east to Bayonne, New Jersey. They contain more than 18,000,000 barrels of oil at all times.

In the Gulf Coast area, as well as in other parts of the nation, the advantages of electric power are being realized more and more by pipe line executives.

GULF STATES
UTILITIES COMPANY

General Offices

BEAUMONT, TEXAS LAKE CHARLES, LA.

Sun Line Links Atlantic-Great Lakes

Crosses Three States, Joining Ocean, Lake and Canal. Increase in Barge Deliveries Looked For. River Crossings Featured Line Building

By A. E. Mockler
New York Bureau, The Oil and Gas Journal

Linking Philadelphia, on the Atlantic Seaboard, with Cleveland, on the Great Lakes, and Syracuse, on the New York State Barge Canal, the gasoline pipe line system of the Sun Pipe Line Co. and the Susquehanna Pipe Line Co., subsidiaries of the Sun Oil Co., is nearing completion, and by midsummer are expected to be in complete operation. Completion of the Sun gasoline line will bring rich eastern and the Ohio River Valley markets

Gasoline line in Pennsylvania extending through abandoned asphalt road and through railroad underpass.

virtually into the "back yard" of the Sun's Marcus Hook refinery, and will materially widen the sphere of operations of the Sun company, as well as to further integrate its marketing operations in territories in which it has expanded in a large way during recent years.

Present plans of the company, in connection with the operation of its new line, contemplate the expansion of its bulk terminal at Van Port, near Pittsburgh, on the Ohio River, with that point to be the location of an extensive river distributing system, utilizing barge tankers on the Ohio River. The Sun Oil Co. at present has two 80,000-bbl. storage tanks at Van Port, and it is expected that additional storage, river loading facilities, etc., will be established at that point, and an important fleet of river tankers placed in operation.

The question of a pipe line transportation system for gasoline first came in for serious consideration by Sun Oil Co. officials in 1928. At that time, there were only a few short gasoline lines in this country, and the problem of constructing a major line in eastern territory, because of the difficult terrain in Sun's territory, presented many difficult aspects. Executives of the company, however, believed the plan feasible, and in the following year W. C. Kinsolving of Beaumont, Tex., started an engineering survey in connection with the proposed Sun line. Aerial surveys and the other preliminary work occupied the greater part in 1929, and in March last year the Sun Pipe Line, Inc., was incorporated to build the section of the Sun line to run into New York State and the Susquehanna Pipe Line Co. was incorporated later in the same month to build the line in Pennsylvania.

Big Right of Way Job

Preliminary work involved the use of a large field force of right of way men, and branch offices were established at Westchester, York, Reading, Greensburg and Wilkes-Barre, Pa., and at Binghamton and Syracuse, N. Y. The work of the right of way force included the obtaining of approximately 1,058 road, 161 railroad, 33 electric car line, 37 river and 671 stream permits, or a total of 1,960, together with numerous special permits covering blasting in streams, storage of explosives, etc.

Sun gasoline pipe line in Little Schuylkill River at Tamaqua, Pa. Line was boxed in wood and boxing filled with hot tar to protect pipe from extreme corrosion of waters of this stream, which flows from coal mines. Line forced to go through this stream as it is the only available gap in mountains in this vicinity.

Frank L. Hadley of Moundsville, W. Va., was appointed general superintendent and placed in charge of the pipe line companies' operations in April, 1930, and the work of line construction has since gone forward under his management.

Considering the difficulties of construction and the type of line built, construction of the Sun gasoline pipe line system has progressed with remarkable speed. The company contracted on July 2, 1930, with the McPherson Construction Co. of Dallas, Tex., to build the line from Twin Oaks, near Marcus Hook, to Cleveland, and from the Icedale pump station in Chester County, Pennsylvania, to Deer Path Gap, near Reading, Pa., a distance of 433 miles, consisting of 6 and 8-inch pipe with 70 miles of branch lines, mainly of 3-inch pipe, reaching Allentown, Harrisburg, and other cities along the route. Supervision over the line's construction was started on July 25, 1930, by John D. Hackstaff of Los Angeles, chief inspector of the line, and from that date until work closed down for the winter, in January of this year, Mr. Hackstaff and his assistants remained in the field.

Many Construction Problems

The Susquehanna Pipe Line Co.'s section of the line was built by the United

Rocky stretch along gasoline pipe line north of Shickshinny, Pa.

Engineers & Constructors of Philadelphia. This section, running from Deer Path Gap, near Reading, to the New York-Pennsylvania State line south of Binghamton, covers 135 miles. Work on this section was started late in July, with pipe laying completed on November 29.

The Susquehanna section developed some of the most difficult phases of the line's construction, notably in the mountains of this region and the anthracite coal fields through which the line passed.

Sun gasoline pipe line makes 7,400-foot crossing of Susquehanna River. Photo taken in midstream when water was at lowest ebb in history as result of drought.

One of the principal problems on this stretch of line was encountered where the line was laid through the town of Tamaqua, in Schuylkill County, Pennsylvania. Here for a distance of approximately 12,000 feet the line was laid in the bed of the Little Schuylkill River, this unusual placement being made necessary by the presence of coal workings underneath the lands lying on both sides of the stream. As explained by Mr. Hadley, the company assumed that coal would not be mined from under the river bed, which was also parallel with the highway on one side and the railroad on the other side, and the river, therefore, was selected as the safest location for the line. Due to the high acid content in the river water, special attention was given to the building of the line through the stream. The pipe, extra heavy 6-inch of 28.573 pounds per foot weight, after being welded and tested, was encased in a specially treated redwood box 12 inches square inside, fastened with monel metal nails. The box was then filled with hot asphalt and the cover nailed on, the box then being lowered into the trench which had been dug in the bed of the river, and covered over with earth and other fill. This method of protecting the pipe was also used on the creeks containing acid waters on both the northern and western sections of the line in Pennsylvania.

The pipe used in the line was seamless tubing of .20 to .30 per cent carbon content, with ends beveled 45° for welding, rolled and tested under rigid inspection, and subjected to a hydrostatic test

Going through a rocky country in Pennsylvania to construct gasoline pipe line.

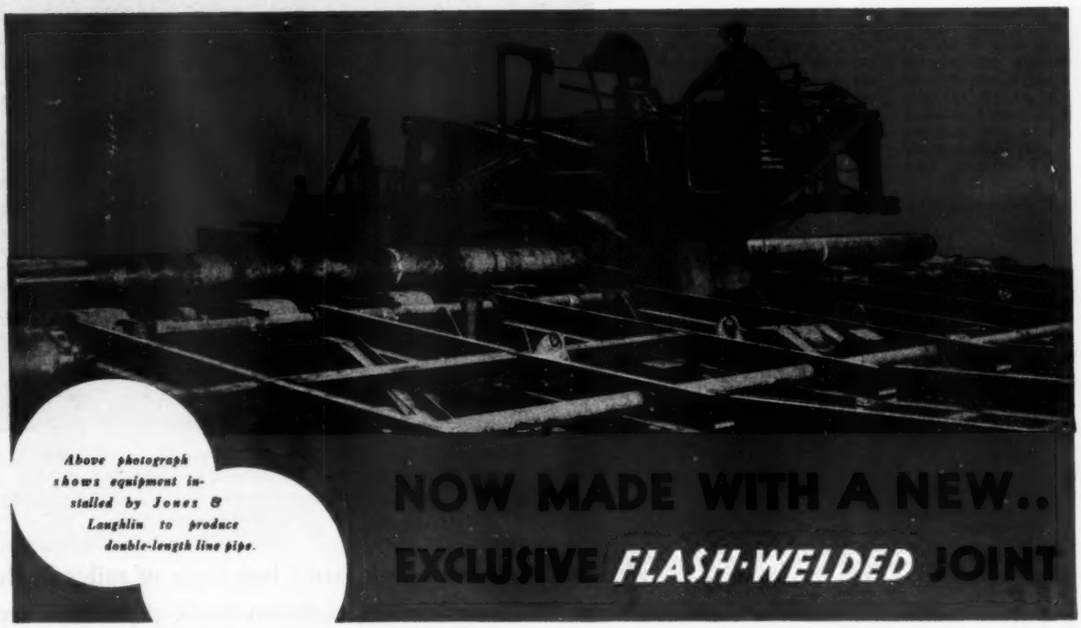
of 1,500 pounds per square inch before leaving the pipe mills.

The pipe used in the 8-inch line between Twin Oaks and Icedale pump stations, a distance of 32.55 miles, weighed 28.55 pounds per foot, while the 6-inch pipe laid in the main line west and north of Icedale was of 18.974 pounds weight, with the exception of certain sections of the line where extra heavy 6-inch pipe weighing 28.573 pounds was used. For the Allegheny and Susquehanna River crossings, double extra heavy 6-inch pipe of 42.55 pounds per foot was employed and this size and weight pipe was also used for the Lake Onondaga crossing near Syracuse, N. Y.

Explaining the construction operations

Deep cut in Schuylkill County, Pennsylvania, for the Sun company's gasoline line.

J & L DOUBLE-LENGTH LINE PIPE



Above photograph shows equipment installed by Jones & Laughlin to produce double-length line pipe.

NOW MADE WITH A NEW.. EXCLUSIVE *FLASH-WELDED* JOINT

AFTER exhaustive research, the Jones & Laughlin Steel Corporation now offers to the Oil and Gas Industry, J & L double length pipe in sizes from 1" to 12", inclusive, joined by a process that provides a joint of forging characteristics.

The new J & L process is an adaptation of flash welding. First, the two ends to be welded are uniformly heated by electricity. When the proper temperature has been attained, the two lengths of pipe are joined by being pressed together.

The exuded metal, coated with oxide, gathers as beads on the inside and outside of the joint. On the inner surface, sufficient metal is removed to permit drifting. On the outer surface, the oxide coating is removed, leaving a small dense pad of metal. Inspection, and a thorough hydrostatic test conclude the process.

Oxidation and decarburization, as well as strains due to unequal expansion and contraction, are virtually eliminated. Any blow holes which might tend to form are pressed out during welding.

Flash welding equipment of special design and large capacity has been installed; large orders can thus be filled promptly.

CASING DRILL PIPE · TUBING LINE PIPE · J&L PIPE · SEAMLESS · WELDED

JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON AND STEEL WORKS

JONES & LAUGHLIN BUILDING, PITTSBURGH, PENNSYLVANIA

Manufacturers of Seamless and Welded Casing, Tubing, Drill Pipe and Line Pipe, and Welded Steam, Gas and Water Pipe in both Black and Galvanized

J&L STEEL

Also makers of Bars, Shapes and Plates, Reinforcing Bars, Cold Finished Steel, Junior Beams, Steel Piling, Fabricated Structural Work, Steel Barges, Wire Products and Tin Mill Products

DOWN TO THE SEA IN PIPES

Interior and exterior views of the Van pumping station, one of six stations on the Pure-Van line, where G-E equipment and Worthington pumps daily keep Van field petroleum moving on its way toward the Gulf

FROM wells and tank farms hundreds of miles in the interior of the United States, eighteen trunk pipe lines are carrying the crude to refineries, to market, to the Gulf of Mexico. Behind this mighty flow, this black-gold river, with its maximum daily tide of 800,000 barrels, are motor-driven pumps.

Conspicuous among these pipe-line motor-and-control installations is the Pure-Van line of the Pure Oil Co. Here, six stations with a total of 6000 horsepower in G-E motors can maintain a daily flow of 45,000 barrels from Van, 211 miles to Smith Bluffs, Texas. Another installation of distinction is on the Texas Company's line from southeastern New Mexico to Port Arthur, a stretch of 692 miles.

These and many other installations give ample evidence or the knowledge, wide experience, and high quality of materials with which General Electric meets all the needs of the oil industry. For specific information on any type of equipment, get in touch with the nearest G-E office.

As a pipe line engineer, you will appreciate the use of G-E wound-rotor motors on low-head, full-capacity, centrifugal booster pumps. This application — a development of General Electric — permits maximum flow regardless of the viscosity of the oil. It is another item in the list of economies that are associated with the use of G-E motors and control.

200-496A

GENERAL ELECTRIC

SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES

of the line, Mr. Hadley said: "The line was oxy-acetylene welded throughout, under the supervision of a chief welding inspector in charge of the entire line, assisted by two welding inspectors in addition to a general inspector with each construction crew. During the laying, sections containing welds were cut out at frequent intervals and were then subjected to strength tests which were made on a portable testing machine. In welding the joints the greatest care was used to insure the pipe being well lined up and the ends properly spaced before tacking and welding. 'Bell-hole' welds were made at all intervals of approximately five or six already welded joints to fuse the line into one continuous length. These welds, made on the ground, were not proved until the line received its final air test, and because of this only the most skilled welders were selected for this difficult task. The line, when laid and welded, was tested with air pressure, all welds being gone over with soap and water. When laid in the trench and covered the pipe was considered to be bottle tight, and this opinion was confirmed when the hydrostatic test of 1,200 pounds was put on the line after its completion.

"As the welded length was laid, it was snaked in order to accommodate as much pipe in the line as possible, and in addition to this, the line was held in crotched skids on the higher elevations until it was laid in the trench and covered in the valleys and lower lands. After this had been done the skids were removed and the pipe on the elevations allowed to settle into the ditch. During the hot months of summer and fall this lowering of the pipe was done between midnight and sunrise. By reason of these precautions the maximum amount of pipe was placed in the trench, thus insuring proper operation of the line and avoiding the danger of the pipe pulling apart through contraction during the winter months."

Railroad and Highway Crossings

As far as feasible, a standard type of construction was used in crossing the numerous railroads and highways encountered by the line. Ten-inch steel pipe weighing 32 pounds per foot with welded joints was used as casing. Under all hard surfaced roads the line was installed in casings and in some instances, notably in Ohio, casing was used under main dirt roads as well. All railroads and hard surface highways were bored and the surfaces undisturbed save in the few cases where rock was encountered.

The valves used in the Sun gasoline pipe line system are of forged steel with rising stems and steel ring gaskets and are placed at an average distance of 5 miles apart. At the foot of high elevations or long upgrades forged steel stop and lift check valves have been installed. Extra heavy nipples were used and these were electric welded into the valves before being delivered onto the line. Steel boxes are used as valve covers and these likewise were welded to the valves before being installed, and were equipped with hinged lids furnished with heavy steel staples for locking.

In laying out the route of the Sun line, it was found necessary to cross two large rivers, and these crossings furnished some of the "high lights" of the project. One, the Susquehanna, is crossed by the line four times, the most important of these crossings being about three-quarters of a mile below the new concrete bridge carrying the Lincoln Highway across the river between Columbia and Wrightsville. At this point the river is 7,450 feet wide as surveyed for the pipe line, and for the greater part shallow with rocky bottom. Construction of this river crossing was greatly facilitated by the fact that the Susquehanna during the summer of 1930 was at the lowest level in years, making possible the blasting out of a channel for the line in the rocky bed of the stream. The pipe laid in the river crossing was of 42.55 pounds per foot weight, and after being laid upon the skids was welded and the joints reinforced with heavy steel collars 9 inches long slipped on over the welds. The ends of the collars were welded to the pipe, giving the joints extra strength and adding extra weight to the line. In the channel, river clamps, each weighing 500 pounds, were bolted over the long collars, and after the line was lowered into the trench, the pipe was anchored to the rocky river bottom by means of heavy river hooks at all places where there might be danger from ice floes or other bodies moving down the river. After this operation, the rocks were replaced on top of the pipe in the trench, these rocks being cemented together in some instances, notably on the edges of the stony islands crossed by the line.

In crossing the Allegheny River near Blaw-Knox, above Pittsburgh, the same type of construction was followed as on the Susquehanna River, except that in the Allegheny, the river being deep and navigable, the trench was dredged across the river and two 6-inch lines were laid off from barges. After being welded the pipe was given a coat of Bitumastic enamel as a protection against corrosion.

Both the Allegheny and Susquehanna River crossings were laid under the supervision of Pat O'Brien, generally regarded as the dean of American pipe line men. Mr. O'Brien was one of the gang which laid the first oil pipe line near Titusville in 1872. As superintendent in 1892 he laid the line of the Crescent Pipe Line Co. across Pennsylvania and was in charge of the line until it was taken up under his supervision 37 years later, in 1927. For a distance of 30 miles from near Lovely pump station in Bedford County, Pennsylvania, to near Ligonier in Westmoreland County, the line of the Susquehanna Pipe Line Co. follows this old survey of the Crescent Pipe Line Co. It is on this section of the line that the greatest elevation of the line between the Atlantic Ocean and Lake Erie—2,860 feet—is attained, where the summit of the Allegheny Mountains is crossed near the Cambria-Somerset County line.

There are eight pump stations along the Sun gasoline pipe line, located as follows: Twin Oaks, near Chester; Icedale, near Downington; York, near Thomasville; Chambersburg, near St. Thomas; Lovely, near Alumbank; Allegheny, near Blaw-Knox, and Van Port, all located in Pennsylvania on the line to Cleveland, and Tamaqua, near Tamaqua, Pa., on the line to Syracuse.

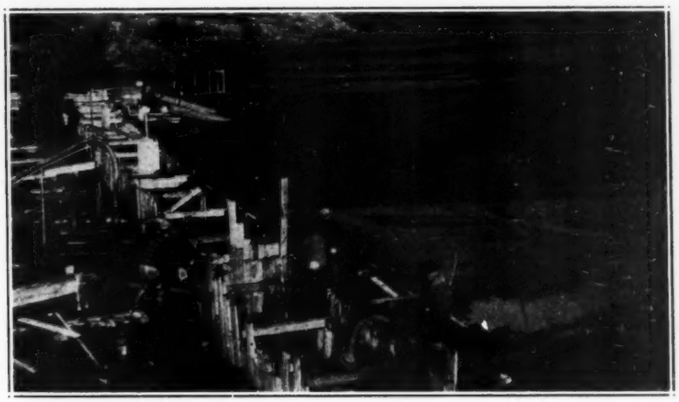
The pump houses are of brick construction, and are equipped with centrifugal pumps, motor driven.

After the line had been finished as far west as Beaver, Pa., a distance of 310 miles, it was subjected to the final air test with a closed-in pressure of 100 pounds per square inch. After this air had been blown out to clean the pipe, the line was filled with water and the final hydrostatic test of 1,200 pounds per square inch was put on the line recording gauges to detect any pressure drop or leaks. In the pipe-mileage tested there were approximately 42,000 welds, and not a single leak in the welds over this entire section was found, the recording gauges showing no loss in pressure during the 36-hour test period.

Final construction of the Sun gasoline line is now under way in Ohio. The city of Cleveland has granted the Sun Pipe Line Co., which is building this section of the line, a franchise to lay its lines across and occupy certain streets in the city, entrance to which is being made over the right of way of the Wheeling & Lake Erie Railway. Along this railroad, the line is now being built for a distance of 21 miles, much of the pipe along this route being coated and wrapped as a protection against the cinder fills.

The route of the Sun gasoline line carries it over many varying types of terrain, the pipe line crossing the tobacco lands of Lancaster and York Counties, the farming sections of Adams and Franklin Counties, Pennsylvania, through the hard coal mining section, and across the mountain ranges in Fulton and Bedford Counties, Pennsylvania.

Gasoline pipe line crossing Stoney Creek, near Johnstown, Pa.



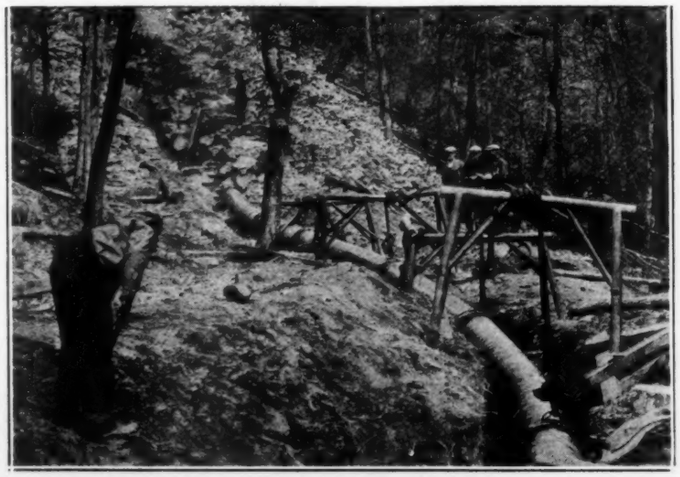
Sun gasoline line crossing the Schuylkill River at Port Clinton.

A feature of the line construction not encountered by pipe line builders in the oil fields was the special attention given to the protection of trees and shrubbery growing along highways and rights of way used by the line. To protect these, the company arranged with a tree protection organization which placed field crews along the line to take the necessary precautions for the preservation of trees and shrubbery. These crews advised the construction inspectors on the avoidance of unnecessary damages to trees, and treated the injuries, such as broken branches and cut roots (and in some instances feeding, where it was found impossible in laying the line to avoid severely cutting roots of trees).

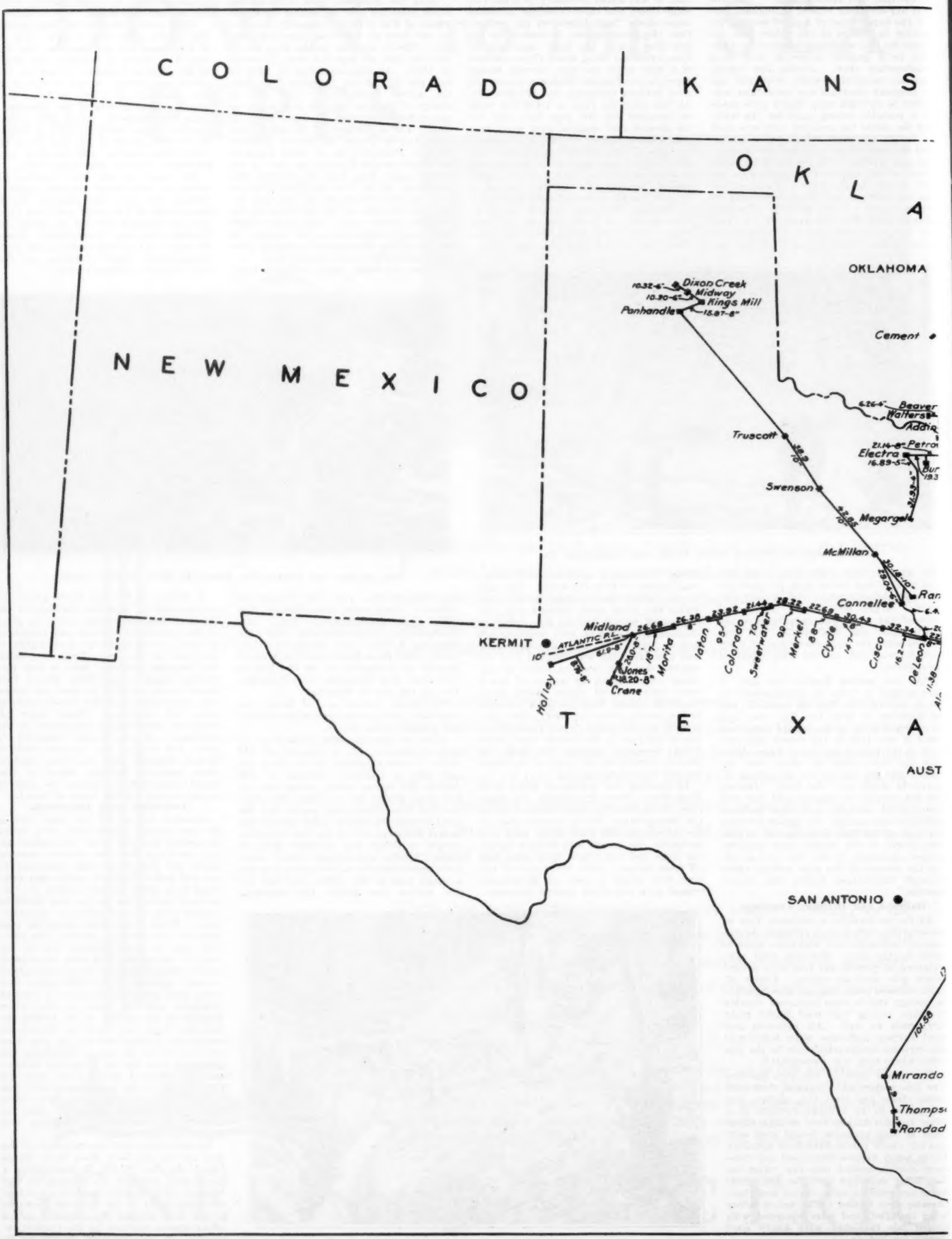
Protection from Electrolysis

Another feature of the pipe line is the precautions which have been taken to protect the pipe from electrolysis action resulting from the electric currents which are picked up from proximity to car and power lines, or which may originate from other outside sources or from galvanic action due to the pipe being in contact with soils of different characteristics. When the current leaves the pipe some of the metal is carried into solution, and to guard against this as the work of laying the Sun lines progressed, preparations were made for an electrolysis survey. Approximately 2,500 copper test wires were welded to the pipe in selected locations and the tops of the wires brought to the surface of the ground before the trench was filled in. This made permanent connections to the pipe line and served as an aid in obtaining the necessary data for the mitigation of electrolysis. Record sheets were prepared showing the exact location of each test terminal as installed, and these were used by the test parties in the field for locating the test points, recording test data, and observations.

In connection with the terminal of the Sun line on the New York State Barge Canal, the Sun Oil Co. is establishing a large bulk terminal at Albany, on the Hudson, and likewise operates an extensive bulk plant at the Syracuse terminal of the line, placing the company in an advantageous position for the further expansion of its marketing operations in New York and New England.



Around the curve and up the hill.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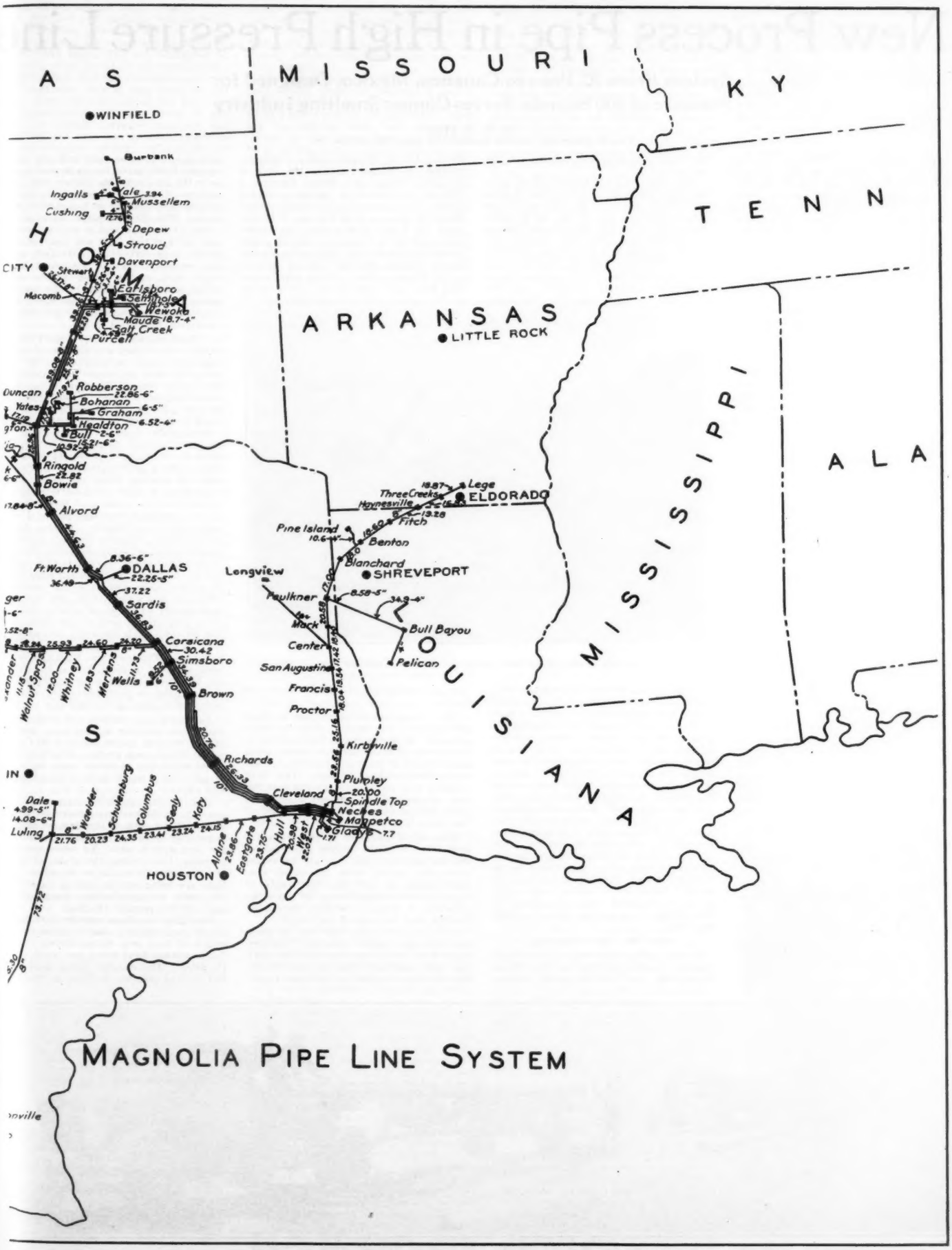
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Salt Creek
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Robberson 22.86-6"
Bohanan 6-5"
Graham 6.52-6"
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Ringold 22.82
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SHREVEPORT
Longview
Faulkner
Mack
Center
San Augustine
Francis
Proctor
Bull Bayou
Pelican
Kirbyville
Pluroley
Spindle Top
Neches
Magpetco
Gladys
Ft. Worth
DALLAS 8.36-6" 22.25-5"
Sardis
Corsicana 30.42
Simsboro
Wells
Brown
Richards
Cleveland
Dale 4.99-5" 14.08-6"
Luling
Waelder
Schulenburg
Columbus
Sealy
Katy
Aldine
Eastgate
Hull
HOUSTON
MAGNOLIA PIPE LINE SYSTEM

New Process Pipe in High Pressure Line

System From El Paso to Cananea, Mexico, Designed for Pressure of 900 Pounds. Serves Copper Smelting Industry

By H. G. Frost
Vice President and General Manager, El Paso Natural Gas Co.

The building of the Western Gas Co.'s high pressure natural gas pipe line 12¾ inches in diameter and capable of working at a pressure of 900 pounds, together with four compressor stations at a cost of approximately $6,000,000 by the Western Gas Co., a subsidiary of the El Paso Natural Gas Co., is progressing rapidly and the line will be completed 45 days ahead of schedule. The line will extend westward from the present terminus at El Paso, Tex., to Douglas and Bisbee, Ariz., and Cananea, Mexico, to serve the Phelps Dodge Corp., the Calumet & Arizona Mining Co., the Cananea Consolidated Copper Co., the Arizona Edison Co. and adjacent and intervening territory.

Paul Kayser is president of the El Paso Natural Gas Co. and the Western Gas Co. H. G. Frost is vice president and general manager of both companies. A. L. Forbes, Jr., is general superintendent of both companies.

Ford, Bacon & Davis, Inc., designed the line and compressor stations, prepared the plans and specifications and supervised the construction of the line with Russell Strong as resident engineer assisted by George O'Connor, field engineer.

Stone & Webster Engineering Corp. has supervision of the construction of the compressor stations and, likewise, exercises a general supervision of the entire project with J. B. White as superintendent in charge of construction and W. D. Stewart as resident engineer.

Contract for the construction of the entire line was let to Bechtel Kaiser Co., Ltd., of San Francisco, Calif., with C. P. Bedford and Edgar Kaiser in charge.

E. G. de Coriolis representing the Surface Combustion Co. of Toledo, Ohio, has been employed by the Western Gas Co. to co-operate with the smelters in installing all gas burners.

Pipe Made by New Process

The 16-inch and 12¾-inch pipe used on the line was manufactured by the A. O. Smith Corp. of Milwaukee, by a new process. The 12¾-inch pipe has an ultimate tensile strength of about 80,000 pounds per square inch, and the finished pipe shows a yieldpoint of about 30 per cent in 2 inches. This line will have a capacity of substantially 52,000,000 feet daily. Pipe of smaller size than 12¾-inch was purchased from Republic Steel Corp. of Youngstown, Ohio.

The welding was done by A. O. Smith Corp.'s electric method, separate generators being used for each welder. The procedure in the firing line weld was to line up and tack on skids up to 10 joints of 40-foot pipe. This pipe was double belled, with a welding ring. Each welder did a complete string of pipe, making his first pass and moving down the line, and then returning and making the second pass.

The line being constructed at the present time starts at a point about 6 miles east of the center of El Paso on the existing line from Jal, N. M., to El Paso. From this point the 16-inch line extends in a northerly direction 7¾ miles to compressor station No. 3. At this point the line is reduced in size to 12¾-inch (outside diameter) pipe, and continues on in a general northerly direction along the east side of the Franklin Mountains through a gap known as Anthony Pass, and down the west side of the mountains to the Rio Grande Valley. About 6 miles of line passes through the irrigated section along the valley, across the Rio Grande River; thence for about 3 miles through rough sand hills up onto the mesa. From this point for 50 miles the line extends almost straight to the north end of the Florida mountains, across flat, practically level ground. From this point the line starts to swing south across practically level range land to Antelope Pass, through the Pellincillo Mountains, a distnace of about 82 miles; thence the line follows through level valley down to the Pedregosa and Peralla Mountains for about 5 miles, where rather rough country is encountered, and from there the line extends in a general slope to Douglas, Ariz.

Getting ready for ditching along the El Paso-Cananea line.

Only One River Crossing

At this point an 8 and 6-inch branch extends to the smelters of the Phelps Dodge Corp. and the Calumet & Arizona Mining Co. at Douglas, and a 4-inch extension is carried on for the city of Douglas. From the above junction a 10-inch line extends to the west, running down to the international boundary line, about 13 miles west of Douglas. At this point an 8-inch line crosses the border and is carried on down in a general southwesterly direction for 38½ miles to Cananea, Sonora, Mexico. At the take-off of the Cananea line a 6-inch line is carried west and north to the power plants at the mines and concentrators of the mining companies at Lowell, Warren and Bisbee.

It is a remarkable point that in about 290 miles of line there is only one river crossing. This crossing is the Rio Grande River, the distance between banks being only about 140 feet, and the distance between headers about 300 feet. This river crossing was constructed by the installation of two 10-inch welded lines, with river clamps at each joint in the bed of the river.

The valves installed in the main 12-inch line are series 40-cast steel valves. On this section of the line all the valves used were 8-inch with fabricated venturi nipples on each side, the length of taper in these nipples being 20 times the reduction in diameter between the size of the line and the size of the valve.

In no case was the pipe bent in passing through rough country. Factory bends with belled ends were used for both sags and over-bends and for side bends. The ditch was graded to fit these bends, and pipe was either cut and two bell or spiggot bends made, or bends were welded into the line with the center ring. The strings of pipe were picked up by two caterpillers, stabbed and tacked immediately. The tie-in welding machines followed behind the tacker and as soon as the line was tied in it was lowered, with slack loops left about 600 feet apart, the section between the slack loops, which was on the bottom of the ditch, being backfilled. Early in the morning when it was still cool, these slack loops were dropped into the ditch and the line completely backfilled.

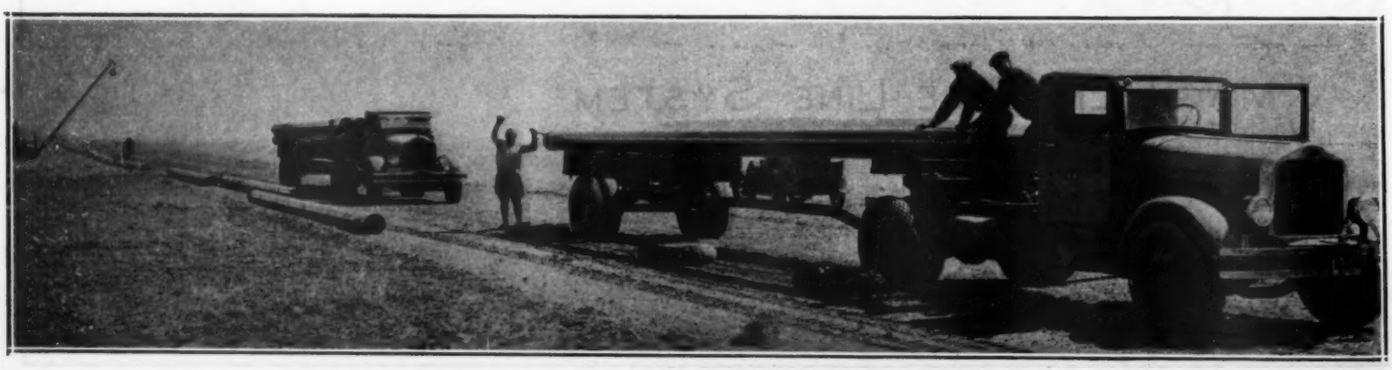
Rock Soundings Every 200 Feet

When the survey was made rock soundings were made at intervals of at least every 200 feet, and these were plotted on the survey maps. These soundings indicated that over a very considerable portion of the line caliche would be encountered from 1 to 2 feet below the surface. Considerable anxiety was felt as to whether it would be possible to cut this with an ordinary type ditcher. When this caliche was encountered it was found that by slowing down the large wheel type ditchers used to about one-half to one-third of the speed used in soft earth, it was possible to cut this material with practically no difficulty. It also was a great benefit, because ditching could be carried ahead with the assurance that the ditch would stand up practically indefinitely. Through the mountain passes and in certain spots along the line conisderable rock was encountered, but the rock encountered, exclusive of caliche, did not cover over 10 per cent of the entire system. Considerable difficulty was encountered in one 3-mile strip in going through lava beds. This rock was hard and somewhat difficult to shoot, but as the ditching had been carried considerably ahead of the laying, no particular delay was experienced in passing through this section.

No timber was encountered in clearing, and it was possible to do a large portion of this clearing by the use of a 60 Caterpillar with a road grader. The only material which had to be cut from the right of way was a small amount of mesquite and yucca.

Due to the unsettled nature of the country, a roadway was constructed along about 80 per cent of the line, so that it is possible to patrol the major portion of the line with a car. No telephone line is being built along the right of way, but at intervals of 20 to 30 miles stub lines are being run in from a circuit on the main transcontinental lines, which more or less parallel the line.

Stringing was done entirely with large trucks and trailers, and in general the length of haul was comparatively short, the maximum haul being not much over 15 miles. The country being generally flat, it was possible to drive to the line



Unloading pipe from trucks. Note the automobile casings alongside truck which act as cushions.

at almost any point desired without long hauls to get around rough country.

A detailed soil analysis was made of the entire line before the starting of construction, and soil samples were taken at least every mile. The soil conditions, in general, were found to be exceptionally noncorrosive, and the recommendation of the engineers making this analysis was that about 30 per cent of the line was in noncorrosive territory, about 40 per cent in slightly corrosive territory and only 30 per cent was in what might be called corrosive territory. The protection used was in all cases a hot enamel. Attempts were made to roll the strings of pipe after welding, but although it was possible to roll the strings, the application of enamel by this method was not found to be satisfactory, and all painting has been done by the brush application of primer and the "Granny Rag" application of the enamel. In sections near the smelters where the soil conditions were extremely corrosive a coating of enamel, followed by a wrapper with a second coat of enamel on top of this, is being used. Where soil conditions were shown to be corrosive, a heavy coating of enamel was used, and where conditions showed only slightly corrosive a lighter coating was applied. In sections shown as noncorrosive, no paint was applied.

It is planned at the present time to operate this line with a maximum pressure of 625 pounds, but the line has been constructed with the idea of probably increasing this pressure at a later date to 750 or 800 pounds. This is made possible by the high yield point in the pipe, the pipe in the mill being given a hydrostatic test of 1,485 pounds, and hammered on the weld while the pressure is on the pipe.

Compressor Stations

There are four compressor stations being constructed in connection with the pipe line, two on the existing 16-inch pipe line from Jal, N. M., to El Paso and two on the new 12-inch line from El Paso to Douglas. The first station is located 72 miles from the gas field, the second 67 miles from the first, the third, near El Paso, 69 miles along the line, and the fourth 108 miles from El Paso near Gage, N. M.

All stations are similar except that the stations on the existing 16-inch line are designed for a maximum gas pressure of 500 pounds per square inch while those on the new line are designed for a maximum pressure of 750 pounds per square inch. All stations have three compressors except the one near Gage which has two. The stations are designed for expansion to an ultimate capacity of eight compressors. A description of a typical station will therefore serve for all.

Each station consists generally of three 760 horsepower double acting twin tandem gas compressors together with the necessary auxiliaries, buildings, water supply, and employes' cottages. The buildings at each station are: A compressor building, approximately 54'x90'; an auxiliary building approximately 20'x71'; a garage and warehouse; a well house and five employes cottages. The compressor, auxiliary and well buildings are of structural steel construction with corrugated asbestos siding and roofs. The garage and warehouse are wood frame construction with asbestos siding, while the cottages are of frame construction. There are four 4-room cottages and one 6-room cottage with recreation hall at each station.

The compressors are double acting 24-inch stroke, those for stations 1 and 2 having 11-inch bore and those for stations 3 and 4 having 9½-inch bore. They are mounted in pairs, each pair being driven by one Cooper-Bessemer 19"x24" twin tandem double acting horizontal gas engine rated at 760 horsepower at 180 r.p.m. The normal working pressure for stations 1 and 2 is 450 pounds per square inch, maximum 500 pounds per square inch; while the normal pressure for stations 3 and 4 is 625 pounds per square inch maximum 750 pounds per square inch. The capacity of the 450-pound pressure compressors is 21,900,000 feet per 24 hours with a compression ratio of two, while the capacity of the 625-pound compressor is 21,400,000 feet per 24 hours with the same compression ratio.

Machine wrapping pipe in the field.

Preparing a tough stretch for blasting.

Cooling System

The gas from each compressor is cooled in a closed gas cooler, those for stations 1 and 2 being 24 inches in diameter by 144 inches long, containing 1,185 square feet of surface and those for stations 3 and 4 being 20 inches in diameter by 168 inches long, containing 869 square feet surface.

The coolers are of the floating head type with cast steel heads, Admiralty tubing and naval bronze tube sheets.

There are two starting air compressors per station, each 5"x2½"x4" two-cylinder directly connected to a four-cylinder gas engine.

The electric generators, water pump, and machine shop are located in the auxiliary building.

Each station is provided with two 50-kilowatt, 480-volt, 3-phase, 60-cyle gas engine driven generators with the necessary switchboards and transformers for the lighting and power system. The ignition equipment includes storage batteries with motor generator charging equipment in duplicate.

The jacket water pumping equipment consists of four 4-inch single stage centrifugal pumps per station each driven by a 15 horsepower squirrel cage induction motor. Two of these pumps take water from the cooling tower basin and pump it through the gas coolers, compressor cylinders and engine cylinders, while the other two take the water from the cylinder overflows and elevate it over the cooling tower.

A 50,000-gallon elevated water tank is provided at each station with the overflow 60 feet above grade. A 5,000-gallon elevated tank is provided for drinking water and domestic use.

A Braun cooling tower 18'x43'x35' high is installed at each station.

The machine tool equipment consists of a drill press, lathe, pipe machine, grinder and power hacksaw, all equipped with individual motor drive.

A 5-ton hand operated crane is installed in the compressor building.

All high pressure gas piping for stations 1 and 2 is series 30 while series 40 is used for stations 3 and 4. All valves and fittings are of cast or forged steel, no cast iron fittings or valves being used for this service. Welded construction is used for the high pressure gas piping.

Several of the compressor sites are characterized by the difficulty in obtaining a satisfactory supply of water. One well is 1,240 feet deep with the water standing 800 feet below the surface and one well is over 1,500 feet deep. Most of the water obtained will require treating to eliminate scale in engine and compressor jackets and zeolite system is being purchased for that purpose.

Ground was broken for station No. 3 on March 1, 1931, and the first compressor was run on gas on May 5, 1931.

List of Principal Equipment

Gas Compressors (manufactured by Cooper-Bessemer Corp.)—760 horsepower at 180 r.p.m., double acting, 24-inch stroke; two compressor cylinders; 500-pound pressure cylinders, 11-inch bore; 750-pound pressure cylinders, 9½-inch bore; four power cylinders, size, 19-inch diameter by 24-inch stroke.

Gas Coolers (manufactured by Alco Products Co.)—500-pound pressure, 24-inch diameter by 144 inches long; five-eighths inch diameter tubes, 1,185 square feet surface, 800-pound pressure, 20-inch diameter by 168 inches long; five-eighths inch diameter tubes, 869 square feet surface; Admiralty tube material.

Starting Air Compressors (manufactured by Ingersoll-Rand Co.)—5"x2½"x4" two-stage; 26.4 cubic feet free air per minute capacity, driven by Waukesha Type V 4"x5" 4-cylinder vertical gas engine.

Gas Regulators (manufactured by Pittsburgh Equitable Meter Co.).

Orifice Meters (manufactured by Foxboro Co.).

Electric Generators (manufactured by Worthington Pump & Machinery Corp.)—50 kilowatt, 62.5 K.V.A., 480-volt, 3-phase, 60-cycle generator; 3-cylinder 9"x10½", 450 r.p.m. gas engine.

Switchboards (manufactured by Ideal Electric & Manufacturing Co.)—5-panel.

Battery Charging Sets (manufactured by Westinghouse Electric & Manufacturing Co.)—1,750 r.p.m., one-half horsepower, 3-phase, 440-volt motor; one-fourth kilowatt, 12-volt D. C. generator.

Jacket Water Pumps (manufactured by Ingersoll-Rand Co.)—4-inch; 600 gallons per minute capacity; 15 horsepower, 1,750 r.p.m. motor.

Water Tanks (manufactured by Pittsburgh Des Moines Steel Co.)—50,000-gallon capacity; 60-foot overflow height.

House Water Tanks (manufactured by Pittsburgh Des Moines Steel Co.)—5,000-gallon capacity; 30-foot overflow height.

Cooling Towers (manufactured by C. F. Braun Co.)—18'x43'x35' high.

Starting Air Tanks (manufactured by Chicago Bridge & Iron Co.)—42-inch diameter by 15 feet long; A.S.M.E. code.

Deep Well Pump (manufactured by American Well Works Co.)—5-pound jack, for Station No. 2.

Deep Well Pump (manufactured by Layne-Texas Co.)—centrifugal, for Station No. 3.

Deep Well Pump (manufactured by Pomona Pump Co.)—centrifugal, for Station No. 4.

Crane (manufactured by Armington Engineering Corp.)—5-ton hand operated.

Thermometers (manufactured by C. J. Tagliabue Co.).

Pressure Gauges (manufactured by Foxboro Co.).

Relief Valves (manufactured by Crosby Steam Gage & Valve Co.).

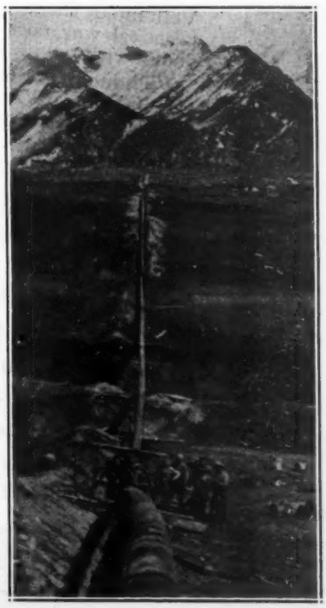
Gates Valves (manufactured by Crane Co.).

Fabricated Piping (manufactured by Grinnell Co.).

Mexican Government Co-operated

A part of the project of the Western Gas Co. is the building of branch lines from its main line at Bisbee, south to the city of Cananea, in the State of Sonora, Mexico. Cananea is a thriving mining town of approximately 15,000 inhabitants. Its chief industry consists of the mines and smelters of the Cananea Consolidated Copper Co., S. A.

In connection with this project it was first necessary to obtain a federal concession from the Republic of Mexico. This concession was granted by the Mexican Government in November, 1930. Governor Francisco Elias of the State of Sonora, recognizing the importance of the industry to his State and the assistance which would lead to the unemployment situation co-operated in every way towards the organization of the Mexican subsidiary company and the obtaining of the concession from the federal department. The Mexican corporation is known as Compania Occidental de Gas, S. A. Every department of the state government co-operated cordially and enthusiastically with the Western Gas Co.'s representatives. In his preliminary work, Mr. Saenz, the present able Secretary of Commerce, Industry and Labor of Mexico, likewise, also broke the customary maze of red tape which all of the applicants are compelled to contend with in dealing with the federal departments of all republics and so expedited the application that the same was granted in the record time of five weeks. Every federal department official in Mexico has assisted the company in every way possible towards the building of this line. The organization of the Mexican subsidiary company and the securing of the federal concession was handled by Frank A. Liddell of the law firm of Huggins, Kayser & Liddell of Houston, general attorneys for the company.



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Design of Modern Oil Pipe Line System

Improvements Include Better Construction and Materials, Newly Developed Methods and Advancement in Technique

By J. N. Hunter
Superintendent, Gulf Pipe Line Co. of Pennsylvania

In keeping with the progress being made in other lines, there is a general tendency toward improvement in crude oil transportation systems. This improvement is not confined to any one part of the system. In the laying of pipe, better materials, newly developed methods and improved technique have combined to produce better pipe lines than have ever been laid before. Better designed stations and more modern machinery and equipment have produced pumping plants which are marvels of efficiency. There is a decided tendency toward building for permanency. More consideration is being given to the health and well being of the men trusted to maintain and operate such a system. The recent completion of the system of the Gulf Pipe Line Co. of Pennsylvania from the Mid-Continent to points in Ohio is characteristic of modern pipe line construction. While there is no one thing which stands out as a definite departure from regular practice, many features are combined which mark the trend as a whole.

The Pipe Line

This transportation system consists of something over 730 miles of 10-inch pipe reaching from a point south of Jenks, Okla., to a point near Spencerville, Ohio. There is also a branch line of 8-inch pipe connecting with the 10-inch line near Dublin, Ind., and extending southeasterly more than 50 miles to a point near the Ohio River west of Cincinnati. All of the pipe used in this system, both the 8 and the 10-inch, was furnished in lengths of about 38 feet with plain beveled ends for welding. Both ends of each joint were belled similarly to the "bell" on the regular "bell and spigot" joint with the inside diameter of the "bell" slightly larger than the outside diameter of the pipe. A short length of regular pipe approximately 8 inches long, properly beleved to permit easy insertion and to present no obstruction, was inserted into the "bells" of adjacent joints. This type of joint is known as the "double bell joint" and has some advantages both in laying and in strength over the ordinary plain end joint. The work of lining up the pipe for welding is facilitated. There can be no icicles projecting inside the pipe. The internal sleeve with the greater diameter of the bell stiffens the welded joint against bending in the weld. The larger diameter of the bell with the same wall thickness gives a weld of greater strength due to more material.

Of the 730 miles of 10-inch pipe, approximately 580 miles was electric arc welded and the remaining 150 miles was acetylene welded. All of the 50 miles of 8-inch was electric arc welded. The reference to welding here is intended to mean the welding into long sections or the "firing line" welding. All of the long sections were tied in or welded with acetylene. The laying of the pipe was started early in July and the line between Jenks and Spencerville was put into operation early in December. The branch 8-inch line to Cincinnati was not started until March of this year and was completed in April. All 8-inch pipe weighed 28.55 pounds per foot and all 10-inch pipe, except that used for river crossings, weighed 40.48 pounds per foot.

Line Crosses Four Rivers

Four important rivers were crossed with the 10-inch pipe line. Beginning at Jenks, they are in order, the Arkansas, the Grand or Neosho, the Mississippi and the Wabash. Practically all of the river crossings were put in during periods of low water in the summer.

The Arkansas was crossed near Jenks where the river bottom is mostly sand. Since the water was low there was but a small channel of water near one bank. A long section previously welded was pulled across the channel and the remainder was laid on the sand in the regular fashion. This crossing was laid of 10-inch 54.73-pound wrought iron pipe weighted with 1,300-pound river clamps. The crossing was given considerable upstream bow and the shifting sands did most of the work of ditching and backfilling.

The Grand River was crossed near Salina, Okla. At the point of crossing, the river bottom is of solid rock. A trench about 4 feet deep and about 4 feet wide at the top was blasted out of this solid rock and the pipe laid on the bottom. The blocks of rock blasted from the trench were laid in over the pipe and the gravel carried by the stream soon filled in the voids. No river clamps were used in this crossing but the usual 54-pound wrought iron pipe was used.

Two separate lines were laid across the Mississippi. Both were laid from barges. One line was laid of 10-inch 54-pound wrought iron pipe while the other was laid of regular 40-pound pipe. Both crossings were given considerable up-stream bend and were heavily weighted with river clamps. At the point of crossing this river has about 5 feet of soft silt in the bottom and the pipe soon found its way to a solid foundation under 5 feet of silt and sand. The crossing of the Wabash presented a somewhat different problem from the rest. At the point of crossing, the river is wide and deep and the bottom is of mud sufficiently hard to carry the pipe. It was therefore, necessary to make a trench before placing the pipe. This ordinarily difficult job was accomplished in a rather unusual and inexpensive fashion. A series of holes at regular intervals was made across the bottom and loaded with dynamite. They were primed with electric caps and the whole series exploded as one shot which resulted in a trench about 5 feet deep entirely across the river. The pipe was immediately pulled into place without difficulty. This crossing is of 54-pound wrought iron pipe weighted with 1,300-pound river clamps.

Station Locations and Grounds

Excluding the initial and terminal stations on this line, there are 12 intermediate stations all alike in design and equipment. The initial and terminal stations differ from the others somewhat in design to meet different conditions but they are equipped in a similar manner. Stations are located near the following places: Jenks and Strang, in Oklahoma; Anderson, Monett, Strafford, Lebanon and Steelville, in Missouri; Valmeyer, Breese, Edgewood and West York, in Illinois; and Jordan, Greenwood and Dublin, in Indiana. Each station site consists of about 40 acres of ground and contains the station building, the working and fuel tanks and the cottages.

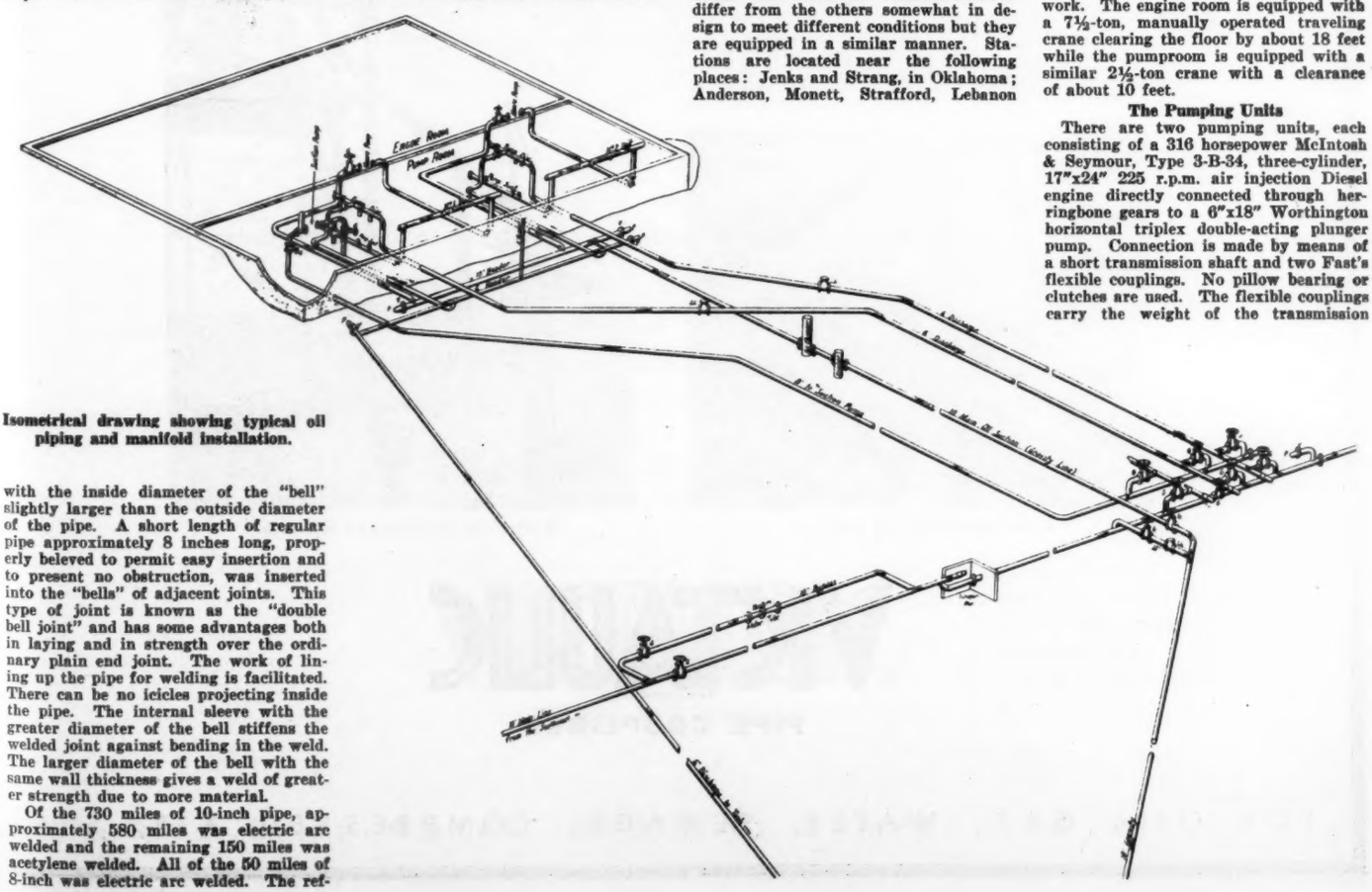
Station Building

The station buildings are of structural steel frame with brick walls and corrugated asbestos roofs. The engine and pumprooms combined occupy an area of 56'x70'.

The pumproom is separated from the engine room by a partition covered on both sides with flat iron sheets. Much of the partition, to the height of 10 feet, is made up of glass windows permitting the engineer in charge an unobstructed view of all machinery from any point in the building. The windows in the partition are of quarter inch plain wire glass set in steel sash. Ventilators of ample capacity are provided in the roof of both the engine and the pumproom to insure a continuous change of air and prevent the accumulation of dangerous gases. The ventilators are provided with means for closing them when desired. Plenty of outside windows are provided for daylight lighting and for additional ventilation. The outside windows like those in the partition are set in steel sash. As can be seen in the drawing, a well lighted and ventilated office has been located in the corner of the building off the engine room. Next to the office is a boiler room containing the boiler for heating the station. Above the boiler room and office is located the locker room with toilet and shower, also a small well-lighted shop for light repair work. The engine room is equipped with a 7½-ton, manually operated traveling crane clearing the floor by about 18 feet while the pumproom is equipped with a similar 2½-ton crane with a clearance of about 10 feet.

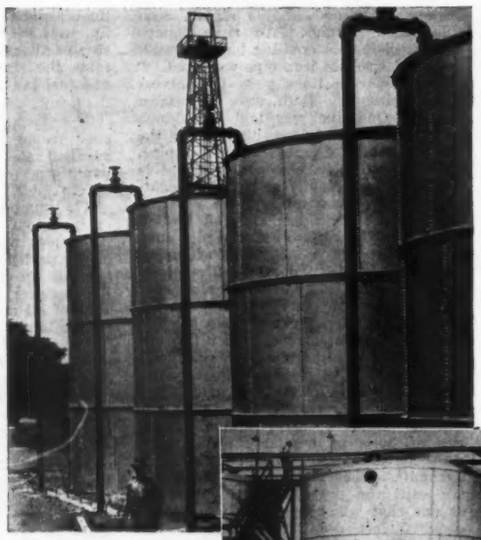
The Pumping Units

There are two pumping units, each consisting of a 316 horsepower McIntosh & Seymour, Type 3-B-34, three-cylinder, 17"x24" 225 r.p.m. air injection Diesel engine directly connected through herringbone gears to a 6"x18" Worthington horizontal triplex double-acting plunger pump. Connection is made by means of a short transmission shaft and two Fast's flexible couplings. No pillow bearing or clutches are used. The flexible couplings carry the weight of the transmission



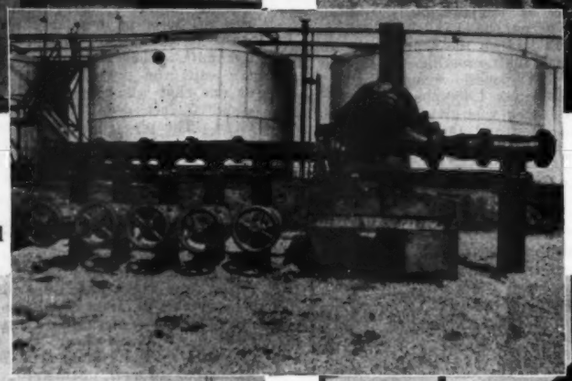
Isometrical drawing showing typical oil piping and manifold installation.

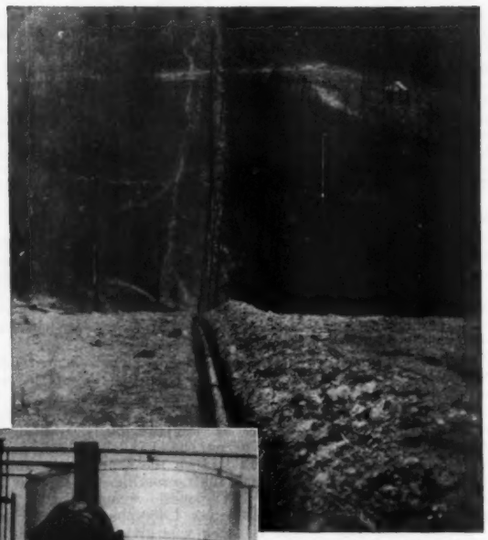
From Oil Well to Tank Wagon



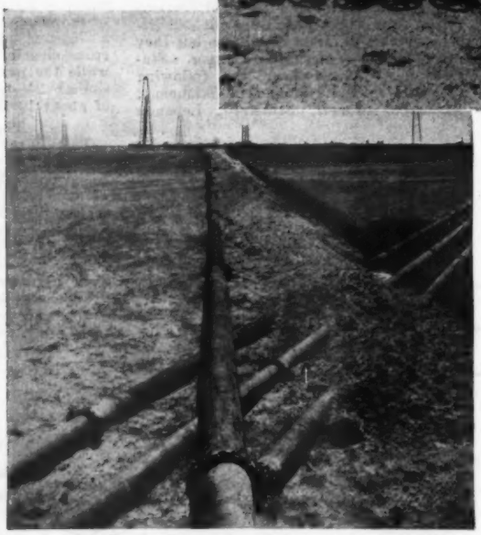
Tank Battery Connections

(Center)
Tank Battery Manifold

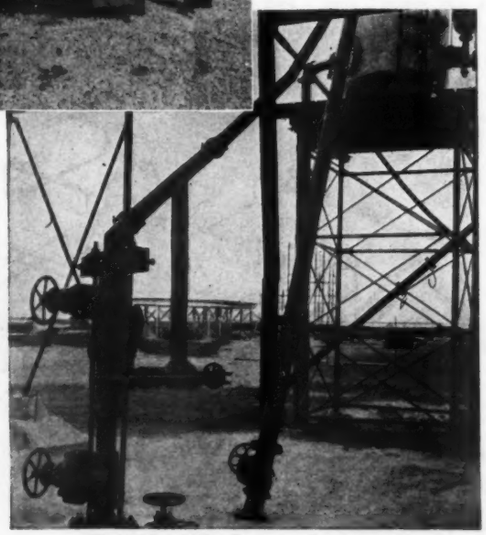




Natural Gas Trunk Line



Lease Lines for Oil and Gas



Well Head Hook-up to Separator

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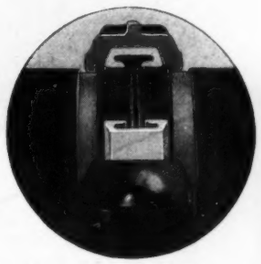

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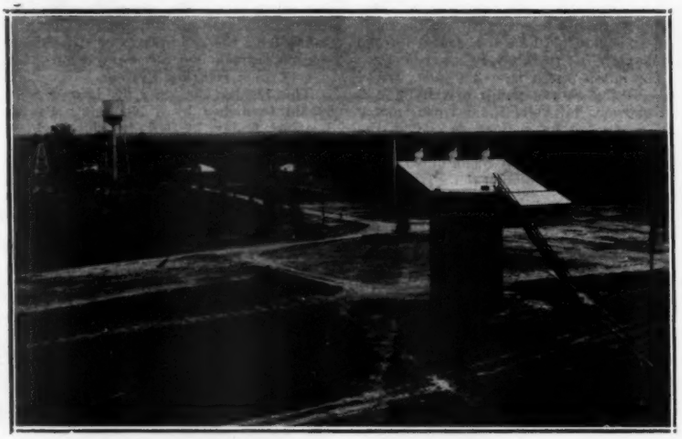
shaft. A bypass valve on the pump serves to unload the engine when starting. The engines are provided with automatic stops to guard against excessive speed and the pumps with pressure relief valves to guard against excessive pressure. The gear ratio of the pump is 5.37 to 1, giving the pump a speed of approximately 42 r.p.m. when the engine is running at its rated speed of 225 r.p.m. Gears, flywheels and transmission equipment are entirely enclosed to guard against injury to workmen. The pumps are equipped with revolution counters for checking pumpings against displacement. Air chambers provided with Jerguson reflex gauges are mounted on the discharge header to dampen pulsations and may be charged with high pressure air from the regular air supply. The pumps are lubricated by gravity feed from a small elevated reservoir attached to the pump. This reservoir also houses a filter through which the oil is passed as it is circulated. The oil passes from the elevated reservoir through the sight feed oilers and then to the bearings. From the bearings it drains to a small sump beneath the pump to be picked up by a small plunger pump attached to the pinion shaft and returned through the filter to the elevated reservoir. The pump lubricating system holds about 5 gallons of oil.

The engine is lubricated by force feed through a positive driven gear pump located in the crankcase on the flywheel end of the engine. A supply tank is located under the engine room floor near the base of the engine. One centrifugal oil purifier serves to maintain the lubricating oil of both engines free from finely divided solid matter.

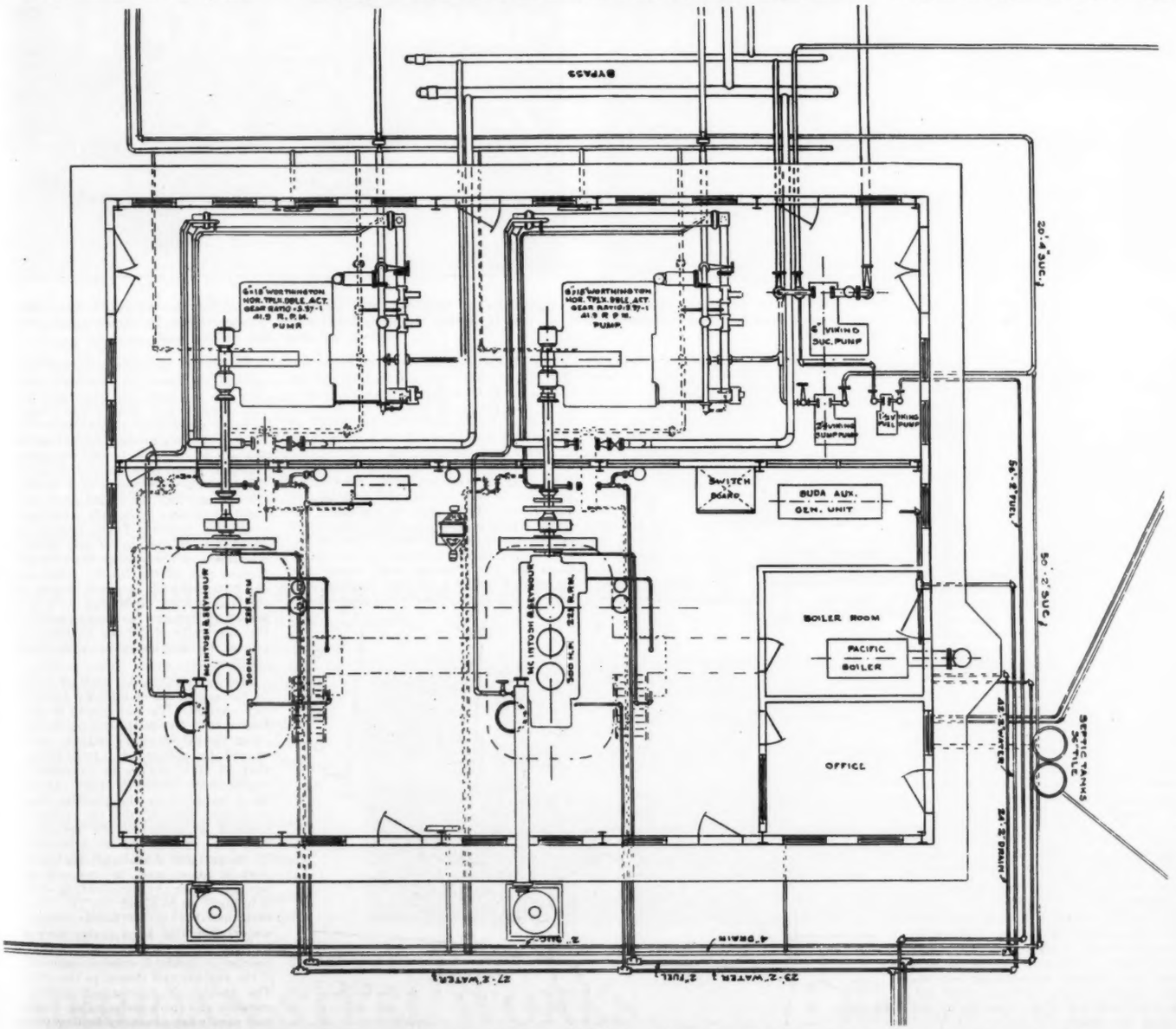
The Cooling System

The cooling system for the two main engines is of the enclosed type, and housed entirely within the main building. Being entirely enclosed, the amount of make-up water required is extremely small and being inside the building, there is no trouble from freezing even when shut down during cold weather. Each engine has its own independent system which is automatically operative whenever the engine is started. It requires less than 20 bbls. of water to fill the cooling system of each unit and since the quantity is small, the quality is not very important. A good quality of well water is generally used but if the water is not changed often a very hard water would be satisfactory. Unlike most closed systems, this makes use of the oil being pumped to cool the water which in turn cools the engine cylinders and heads. A single pass heat exchanger containing 104 three-fourth inch (outside diameter) by 16-foot drawn seamless steel tubes with a surface of about 326 square feet serves to transfer the heat from the cooling water to the oil being pumped.

The system consists of a standpipe of 20-inch pipe approximately 16 feet long set on end near the engine. Except for the pipe and engine jackets, this standpipe serves to hold all of the water contained in the system. From the bottom of the standpipe a 4-inch pipe leads to a 175 g.p.m. 1,200 r.p.m. centrifugal pump driven from the engine transmission shaft through a silent chain drive. From the centrifugal pump, the water is driven through 4-inch pipe to the outside pass of the heat exchanger which is located close to the outside wall of the pump room. From the heat exchanger, the water passes to a header below the engine cylinders and then through branch lines to the various parts to be cooled. A bypass line around the heat exchanger



Anderson, Mo., pump station of the Gulf Pipe Line Co. of Pennsylvania, showing pump and engine house, fuel tank, water tower, cottages and grounds.



Plan drawing of typical pump station showing location of Diesel engines, pumps and other machinery. Gulf Pipe Line Co. of Pennsylvania.

permits regulation of the water temperature without cutting down the flow through the engine jackets. A header above the engine collects the water and returns it to the standpipe near its top. A sight glass shows the water level in the standpipe at all times. Makeup water is supplied manually through a connection to the station water system near the bottom of the standpipe.

Incoming oil feeding the main pumps enters the station through an 8-inch pipe and flows to a 600 g.p.m. 1,200 r.p.m. centrifugal pump located on the pumproom side of the dividing wall but mounted on a common base and driven through the same shaft as the water circulating pump. From the centrifugal pump, the oil moves to the inside pass of the heat exchanger and from the heat exchanger to the suction header of the main pumps. The head produced by the centrifugal pump compensates for the head loss through the heat exchanger and feeds the main pumps continuously with a positive head. Victaulic type couplings are used extensively for both oil and water. The heat exchanger heads are attached to the shell with this type of coupling making the inside of the tubes readily accessible for cleaning and inspection.

Electrical Equipment

Electric power for use in the station, the cottages and on the grounds is supplied by a 37.5 KVA. 1,200 r.p.m. 440-volt, 3-phase, 60-cycle A.C. generator directly connected to a 1½-kilowatt 125-volt direct current exciter, and driven from the main engine shaft through a "V" type belt. The 440-volt current is connected to the switchboard in the engine room on which are mounted the voltage regulator, meters and switches. For lights and other station uses requiring 110 volts, the voltage is stepped down through transformers located above and behind the switchboard. Current supplied to the cottages is stepped down through transformers located near the cottages.

Only one main engine is provided with a generator. In case this unit is not in operation, power is furnished by a generator similar to the one described above but directly connected to a Model BA-6 six-cylinder 4⅛-inch bore by 5½-inch stroke, 1,200 r.p.m., 50 horsepower Buda gasoline engine. This engine is cooled by means of a radiator. The gasoline supply comes from an outside tank buried in the ground.

The pump room is lighted with five 300-watt vapor proof lighting units while the engine room is lighted with ten 300-watt lamps. Reelite extension portable lights are located conveniently on the wall. Electric lights are provided outside the building with flood lights for lighting the tanks.

All of the auxiliary pumps are grouped together conveniently in one end of the pump room and all except the fuel transfer pump are driven through "V" type belts.

The suction pump is a 6-inch Model ZW Viking pump driven by a 20 horsepower, 440-volt, 1,200 r.p.m. motor controlled by an oil immersed push button station in the pump room actuating a magnetic switch in the engine room. This pump is used to remove oil from the main line and manifold and discharges through a separate line to the working tank.

The sump pump is a 2½-inch, Model ZU, Viking rotary pump driven by a 3 horsepower, 440-volt, 1,200 r.p.m. motor and controlled by a float switch at the sump pit. Manual control is also provided by an oil immersed push button station located in the pumproom. Both control switches actuate a magnetic switch in the engine room. As waste oil from the station accumulates in the outside underground sump tank, this pump is automatically started and returns the oil to the system. Manual control allows the starting or stopping of this pump when desired without interfering with the automatic control.

The fuel transfer pump is a 1½-inch, Model ZMK, Viking pump directly connected to a 1 horsepower, 440-volt, 1,200 r.p.m. motor controlled by an oil immersed push button station in the pumproom actuating a magnetic switch in the engine room. This pump is used to take fuel from the pipe line or tank and to transfer fuel from the fuel storage tank to the elevated fuel tank.

A Worthington 4¼"x1½"x5" two-stage air compressor designed to run 500 r.p.m. and for a discharge pressure of 1,000 pounds is located between the two engines near the dividing wall in the engine room. This compressor is driven by a 7½ horsepower, 440-volt, 1,735 r.p.m. motor and is used to supply air to the air chambers on the main pumps, charge starting and injection air bottles on the engine when necessary and to supply air for other uses. The air piping is so arranged that air for any purpose may be taken from the compressor of either main engine or from the auxiliary compressor.

Heating System

The station building is heated with steam furnished by a No. 8,331 Pacific heating boiler located in the enclosed boiler room off one end of the engine room. The boiler is oil fired by a Model D-13 Petro automatic heating unit designed to supply steam for 4,000 to 8,000 square feet of steam radiation. The burner is driven by a one-half horsepower, 110-volt motor, and controlled electrically by Honeywell H-10 "Pressuretrol." The usual range of steam pressure on the boiler is from 3 to 7 pounds. Located within the main building there is little loss of heat either from the boiler or the piping which results in a surprisingly small fuel consumption.

There are six radiators of the unit heater type equipped with three-speed fans which may be run at 1,140, 950 or 720 r.p.m. Two sizes of radiators are used. Three of the larger size, each rated as equivalent to 675 square feet of direct radiation, are mounted in the engine room on the dividing wall above the crane rail. Three of the smaller size with a 455 square foot equivalent direct radiation rating are mounted in a similar manner in the pumproom. On account of the air circulating feature, these heaters are well adapted to mount high on the wall and serve to heat the building quickly and distribute the heated air uniformly. Since they are mounted considerably above the level of the boiler, the condensate returns by gravity, no condensate pit or pump is necessary. The return line to the boiler is equipped with a ball float air trap to remove air. The heating system, like the engine cooling system, is entirely enclosed and therefore, little make-up water is required. The small quantity necessary is supplied through a water level control connecting the boiler to the regular water supply lines.

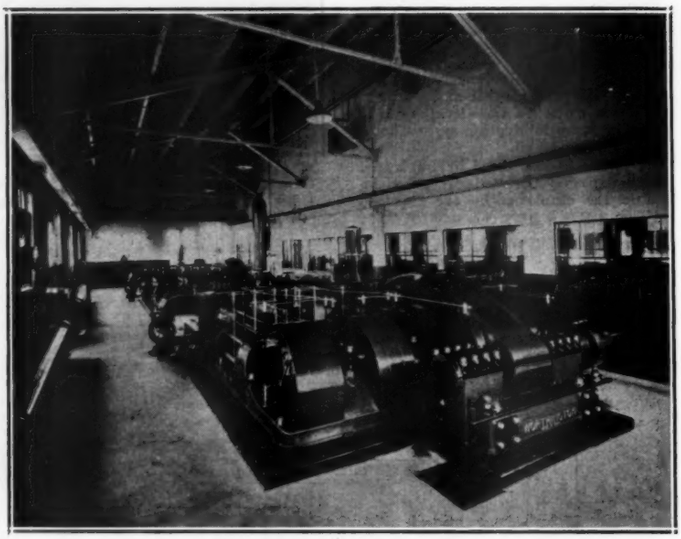
Lubrication

The lubricating oil supply for the two main engines is stored in a 280-gallon storage tank located beneath the station floor near the base of the engines. The storage tank is rectangular and provided with a filter near the middle of its length. The oil is picked up from this tank on the down-stream side of the filter by a positive drive gear pump located in the base of the engine and carried to the important working parts under pressure. A constant pressure is maintained on the oil pressure lines by means of a relief valve which may be set to maintain the desired pressure. The oil after passing over the working parts drains to the crankcase of the engine and from there overflows to the storage tank on the up-stream side of the filter. After passing the filter, the oil is again picked up by the pump and circulated. The filter serves to remove the coarse solids from the oil while the finer material is removed by means of a centrifugal oil purifier.

The centrifugal oil purifier is located in the engine room midway between the two engines. The oil piping is so manifolded that the purifier may be used to clean the oil of either engine, yet so arranged by means of interlocking cocks that oil must always be returned to the engine from which it came. Unpurified oil is supplied to the purifier from the up-stream side of the oil storage tank through a motor driven rotary pump. This pump passes the oil first through a 15 square foot Andale oil heater located slightly above and to one side of the purifier where the temperature of the oil is brought up to about 180° F. The heat furnished by the oil heater comes from water circulated by a motor driven centrifugal pump through the annular space around a jacketed exhaust pipe on one of the engines and thence to the oil heater. The system is maintained under some pressure and the water attains a temperature somewhat above its boiling point.

After being heated, the oil flows to the

Engine side of Anderson, Mo., pump station, housing two 316-horsepower McIntosh & Seymour, Diesel type engines direct connected to Worthington pumps on other side of fire wall.



Pump side of Anderson, Mo., pump station housing two 6x18-inch Worthington horizontal triplex double-acting plunger pumps driven by direct connection to engines on other side of fire wall.

Map of the Union-Gulf Pipe Line Co.'s system.

Plenty "Hot Stuff"... Where You Want It...*QUICK!*

American Chief
Heater, Model "H"

Burns Kerosene and Distillate
250, 500 and 1000 gals.

American Chief Model "H" . . . Made of heavy steel plate, electric arc welded, formed to a half circle radius . . . thus adding to heating efficiency. Front and rear wheels track, and are standard truck tread. Right angle turning radius.

Has half-circle, anti-splash, removable, inside vat . . . keeps the material in constant motion, preventing burning and coking. Double hinged, rain-tight lids with lever lifting device. Built very low for easy charging.

Equipped with American Double Horizontal Coil-less Burner . . . which being at front, blows heat to rear, circulating up and around inside vat and out stack at front. This return heat circulation greatly increases melting capacity.

Model "T" has the same quick quantity melting, fast traveling efficiency of the American Chief . . . but is a smaller kettle for smaller jobs. Made of same high quality, long lasting materials. Has same exclusively American percolating anti-splash inside vat and other features.

AMERICAN
PIPE LINE EQUIPMENT

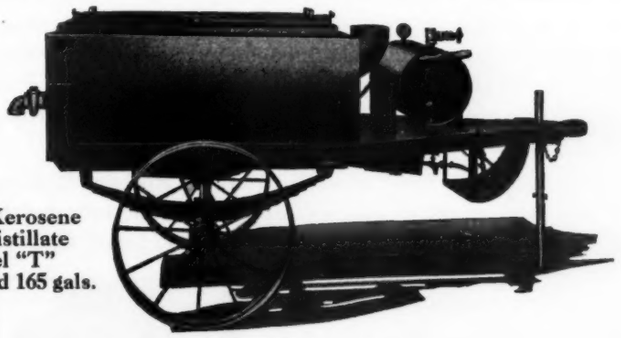
SAVE time on pipe line insulation and repair jobs . . . and cut costs. Do it by using American Equipment.

American Heaters keep your crews on the jump all the time. That's because they are unusually fast quantity melters. Keep the workmen supplied with plenty of "hot stuff" all day long.

Speedy Movability is another time-saving feature of American Heaters. They are built to patrol easily over swampy or sandy ground and roughest country. And stand the gaff of hardest usage.

Complete Pipe Line Equipment . . . We can supply you with highest quality heaters in all sizes and styles, pouring pots, buckets, brushes, pipe cleaners, burner outfits, torch outfits . . . everything you need for pipe line insulation and repair work. Satisfaction guaranteed. Prompt shipment.

Write Today for complete catalog, specifications and prices.



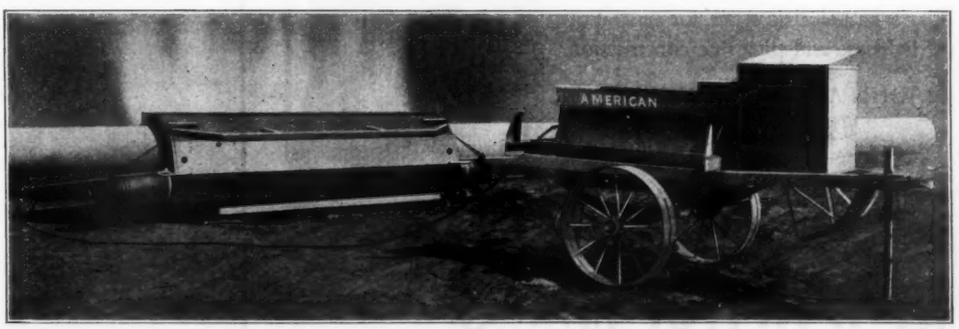
Burns Kerosene and Distillate
Model "T"
60, 110 and 165 gals.

American Pipe Bending Shield and Compressor Unit

Bending Shield made from one-piece heavy sheet steel plate. Produces even heat full length of shield, and bending heat is reached in 15 to 20 minutes. Angle iron sled runners are welded to shield so that it is easily dragged along line. Complete with chain and load binders to clamp shield to pipe.

Compressor Unit consists of one H.P. gas engine, gear driven air compressor and 70-gal. supply tank with emergency air pump. The frame is so constructed that 12 skids can be carried along sides. The two No. 20 double jet torches throw 6" flames and generate a temperature of 2140 F.

Write for complete catalog.



American Pipe Bending Shield and Compressor Unit

AMERICAN STEEL WORKS **Kansas City, Mo.**

Have you tried this "*different*" welding wire?

If not, we urge you to do so. We are glad to have pipe line engineers, contractors and others put this wire through the most critical of tests.

Why Roebling Welding Wire is "different" is easy to understand. We *make* it "different" by using special manufacturing methods, by exercising painstaking care through every step of the production process, and by adhering to most exacting standards. Even the steel we use is special—made from special, selected melting stock and produced in special, small open-hearth furnaces.

Investigate the absolutely unvarying quality of Roebling Welding Wire—the fine, strong, tough welds that are made with it—the economy it assures. Our distributor—Frick-Reid Supply Corporation—will gladly furnish full information and samples for test.

Roebling Welding Wire is made in gas and electric types, for general oil field use and pipe line construction.

JOHN A. ROEBLING'S SONS CO.
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Welding Wire Distributors for Oil Fields
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ROEBLING WELDING WIRE

OKLAHOMA PIPE LINE COMPANY

TRANSPORTERS OF CRUDE PETROLEUM

OPLCo

MUSKOGEE, OKLAHOMA

centrifugal purifier and after being cleaned, is discharged into a small receiver of about 1 gallon capacity. The purifier and receiver are built to retain any vapors from the heated oil and sight glasses are provided for observation of the discharge streams. From the receiver, the oil passes to a second small rotary pump driven by the same motor and mounted on the same base as the charging pump. The hot oil is discharged from the second pump through an air-cooled unit cooler, of 400 square feet equivalent direct radiation rating, and back into the storage tank on the downstream side of the filter. The unit cooler is equipped with a three-speed fan and is similar to the units used to heat the building. The cooler removes heat from the oil in the same manner as the heater units remove heat from the steam. This cooler takes the place of the usual water-cooled heat exchanger and operates with much less trouble. When the engines are running continuously, the purifier operates eight hours out of each 24.

The purifier is driven by a 2 horsepower, 440-volt motor. The capacity of the purifier is 225 gallons per hour. It has a dirt holding capacity of 125 cubic inches.

Station Tanks and Manifold

Each station is provided with one working tank 78 feet in diameter by 40.5 feet high of approximately 35,000 bbls. capacity. This is a seven-ring A.P.I. standard tank with a steel roof riveted and caulked. The inside of the top ring and the underside of the roof are covered with aluminum foil as a protection against corrosion by hydrogen sulphide. Gas-tight thiefing gauge hatches and an approved type breather are provided in the roof.

An 18-foot diameter and 29.5-foot high, five-ring A.P.I. tank of approximately 1,400 bbls. capacity is provided as fuel storage to insure an ample supply of sweet crude for fuel. In addition to the 1,400-bbl. tank, there is a 64-bbl. cone-bottom elevated fuel tank supported by a steel tower approximately 16 feet above the ground, to supply fuel by gravity to the engines and boiler. Since the fuel tanks were intended to contain sweet crude only, no aluminum foil protection was used.

The accompanying isometrical drawing shows a typical oil piping and manifold installation. All of the 12 stations are exactly alike except for some slight differences in piping due to difference in location of tanks. Through the manifold, oil may be received into the working tank or pumped past the station when the pumps are not running. When operating the station, oil may be pumped from the working tank or may be relayed without passing into the working tank. In case of trouble, the suction pump may draw oil from the main line on either side of the station without affecting the working of the line on the opposite side. Should it be desirable to cease discharging oil into the line and yet allow the main engine to run, provision is made for circulating cooling oil from the working tank through the main pump and back to the working tank through the suction pump discharge line. Scraper traps for the insertion and removal of pipe line scrapers are provided on each side of the manifold. In building the manifold and in laying the connecting lines, tube turns and welding neck flanges were used extensively in the welded parts and many victaulic type couplings were used in putting the various parts together.

Cottages

Each station has four to six modern bungalows with five rooms and bath. The construction is frame set on solid concrete foundations. The roofs are of asbestos shingles. Each cottage is provided with a one-car garage served by a graveled driveway. Graveled roads connect all of the cottages with the station and with the main traveled highway. All modern conveniences are provided in the cottages and are connected to the station electric, water and sewage systems. Where possible, the cottages are located on wooded portions of the station site to provide shade in summer. At all stations, the cottages were located to take advantage of the summer breeze.

Water Supply

The water supply for the cottages and the station comes from deep wells drilled on the station grounds. Chemical and sanitary analyses of all water supplies were made before the wells were put into use. An elevated water supply and pressure tank of approximately 20,000 gallons capacity located on a steel tower approximately 50 feet aboveground insures a supply of water for all ordinary purposes as well as ample quantity and pressure for fire protection. This tank is of the usual type with a low cone roof and a hemispherical bottom from which a water leg 36 inches in diameter extends to the ground. All water put into or withdrawn from this tank passes through this leg. Its large diameter prevents freezing in the coldest weather. All outside water lines are buried below frost depth.

The wells vary in depth from 86 feet to 600 feet. They are all equipped with deep well pumps, tubing and rods. The pump rods are attached to a deep well pump head driven through a flat leather belt by a 5 horsepower, 440-volt 1,200 r.p.m. motor controlled by a switch located in the pump house. Each well has a derrick for pulling tubing and rods. The bottom part of the derrick is enclosed to house the pump head and the motor.

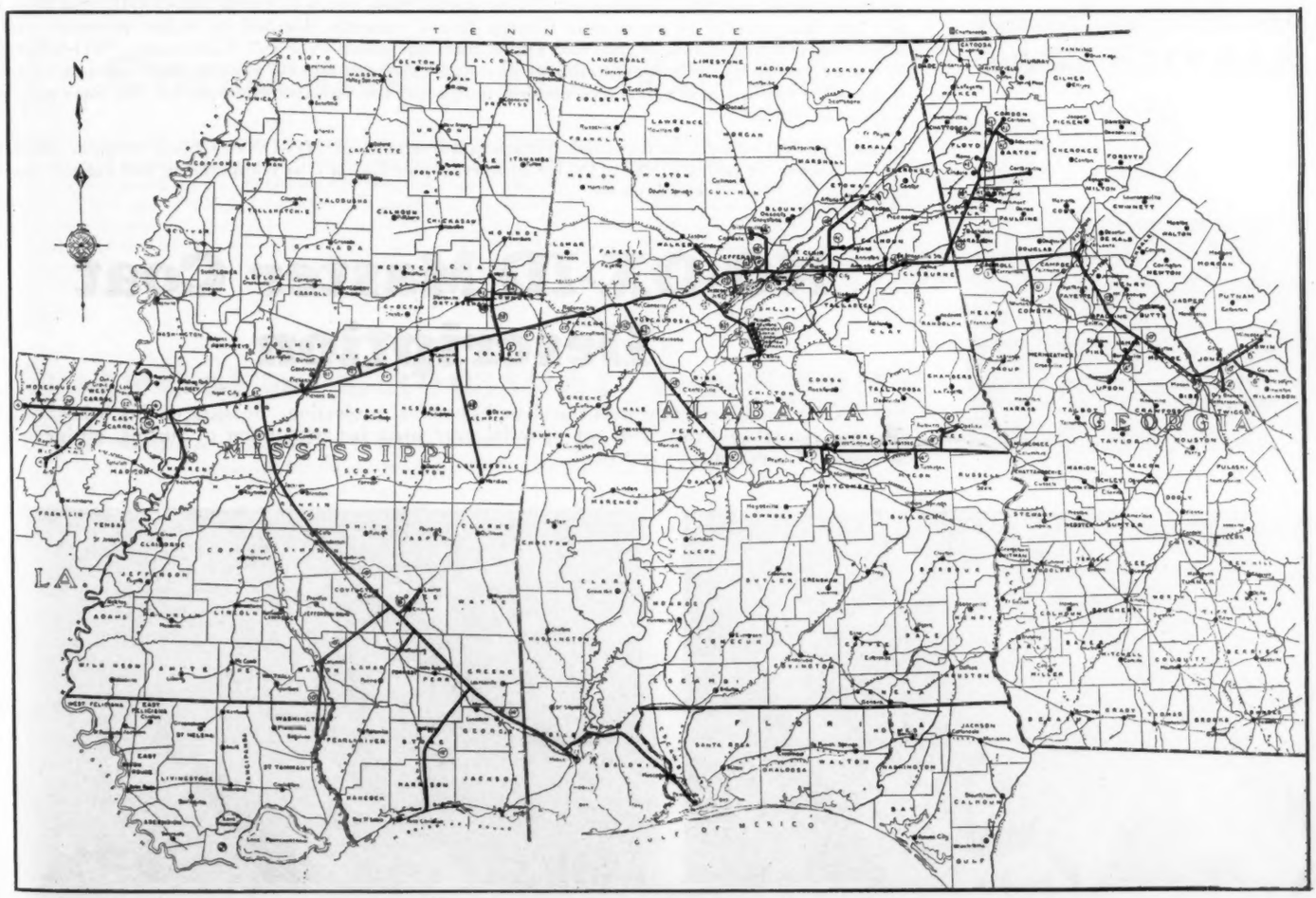
Meters and Automatic Gauges

As stated heretofore, there is but one working tank at each station. In order to avoid evaporation losses as far as possible, this system was designed to take oil from the incoming stream directly into the suction line, apply pressure and pass it on to the next station. The working tank, therefore, serves only as a surge tank or standpipe and not as an ordinary working tank to be alternately filled and emptied. By this method of operation, practically all of the oil is kept entirely within the pipe line, very little is exposed to the atmosphere and the losses from tank breathing are cut to a minimum. In order to measure the oil at each station, Venturi meters were installed to measure the incoming stream. These meters indicate the rate of flow in barrels per hour, make a continuous chart record of this rate of flow and integrate the flow into barrels of oil passing the tube. The instrument is located in the office in easy view of the station operator at all times.

Automatic electric depth gauges show the exact oil height in the tank on a dial located in the office near the Venturi meter. The amount of oil received by any one station is determined hourly by reading the meter, and the amount pumped is readily calculated by adding to, or subtracting from, this amount any change in the content of the tank.

Conclusion

This article has been written to describe a modern pipe line system. Many features of this system are in use on other lines. This new line is typical of modern construction methods. Losses are low because welding provides tight joints and eliminates breaks. Rugged and well designed station equipment permits efficient, low-cost handling of the oil. The good housing facilities and pleasing camp construction indicate the companies' interest in the welfare and comfort of their employes.



Map of pipe line system of Southern Natural Gas Corp. The line from Yazoo City, Miss., to Mobile, Ala., and thence to Pensacola, Fla., including laterals to Gulf Coast towns, has been sold by the Southern to the United Gas Corp.

Endorsed

NO-OX-ID
IRON-OX-RUST
TRADE MARK
The Original Rust Preventive

DEARBORN CHEMICAL COMPANY
NO-OX-ID-IZED WRAPPER
TRADE MARK
NEW YORK CHICAGO

NO-OX-ID
IRON-OX-RUST
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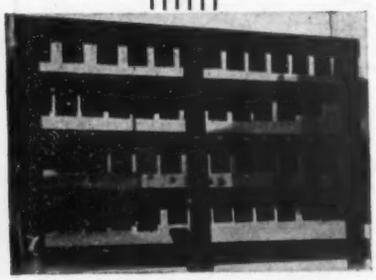
The Original Rust Preventive
SERVICE COAT



An assembly of test plates in the Dearborn Laboratories.

• The NO-OX-ID

What Inspections Show

Oklahoma: Five years ago a city in Oklahoma was piped for gas and the pipe coated with NO-OX-ID. At an inspection in May, 1931, the State Corporation Commission fixed the value of the lines at 93% of new value. *Texas:* "Line treated in 1927 with NO-OX-ID and Wrapper, removed from ground shows pipe to be in perfect state of preservation." *Alabama:* "Inspection of pipe coated with NO-OX-ID five years ago shows no signs of corrosion and the line is still in service." *North Carolina:* "Opened up several test holes, including a number where NO-OX-ID and Wrapper were used. Pipe protected with our material was found in perfect condition. Has been down five years." *Wyoming:* "They just made survey of line coated with NO-OX-ID three years ago and found it in fine shape." *Missouri:* "Inspectors very much impressed with the way NO-OX-ID has functioned. Application of NO-OX-ID and Wrapper five years old and good for a number of years to come." *Kansas:* "A string of twenty-three hundred feet of ten inch casing has been run in three different wells. Threads and casing still in perfect condition and ready for another well. Salt water." *Pennsylvania:* "Pipe exposed to conditions of mine water protected with NO-OX-ID and Wrapper, still in good shape after two years, whereas before pipe lasted only six months." *Louisiana:* "Examination of 8 and 12 inch line re-conditioned and coated with NO-OX-ID in 1922 shows no evidence whatever of new pitting and all old pits inactive. The new line was apparently in exactly the same condition as when inspected in 1926." *California:* "Line coated three years ago with NO-OX-ID and Wrapper and laid parallel to pavement. County Board recently decided to widen pavement and after inspecting condition of line laid a nine inch pavement over it." *California:* "NO-OX-ID, Wrapper and Service Coat applied four years ago through the very worst soil sections of the state, were opened and protective coating found just the same as when put in. All lines passed inspection 100%."

In such typical reports as these has Time's endorsement of NO-OX-ID been written. All of the thousands of miles of NO-OX-ID protected pipe line are as competently and reliably protected as the lines reported above.

NO-OX-ID Master Coat Description

NO-OX-ID combines both mechanical and chemical protection. Because of this it has made the most remarkable record of any material ever used for prevention of rusting, pitting and corrosion of exposed iron and steel.

Inspecting reconditioned line saved with NO-OX-ID. "Results entirely satisfactory."

Twelve-inch line in water. Inspection O.K. after 8½ years.

b y T i m e

MASTER COAT •

NO-OX-ID IRON-OX-RUST TRADE MARK
The Original Rust Preventive

DEARBORN CHEMICAL COMPANY
NO-OX-ID-IZED WRAPPER REG U.S. PAT OFF
NEW YORK CHICAGO

NO-OX-ID IRON-OX-RUST TRADE MARK
The Original Rust Preventive
SERVICE COAT

The NO-OX-ID Master Coat is made up as follows:

(1) Dearborn Pipe Mill Coat. The object of this coat is to give protection to pipe in transit by placing a rust inhibitor on the steel before rusting starts.
(2) NO-OX-ID "G" Special, the rust preventive unequalled which combines chemical rust inhibition and mechanical soft non-drying protection.
(3) NO-OX-ID-IZED Wrapper contains rust inhibiting NO-OX-ID and is supplied in a form complying with the requirements of the job. Applied spirally.
(4) NO-OX-ID Service Coat applied warm at a flowing consistency, gives a film effective in resisting soil stress which does not become hard and brittle on aging.

Costs Are Not High

No premium in price is charged for the greatly superior protection of the NO-OX-ID Master Coat. The cost of the coatings is based on the value of the materials used, but application is considerably below average cost. Measured sensibly on the basis of annual cost of uninterrupted protection, as against the cost of reconditioning due to short life of the protective material, the NO-OX-ID Master Coat is your greatest economy in pipe line preservation. The foregoing statement is strong. So are the facts and figures with which we will back it up to you. We invite you to get complete data regarding the NO-OX-ID Master Coat in giving consideration to the method you will employ for protecting new work or in reconditioning old lines.

Constantly Improved

The NO-OX-ID Master Coat embodies all that has been found valuable in many years of research and experience in pipe line protection. The Dearborn Laboratories have worked constantly for years on this problem striving for improvement. They have developed much of great value. They are working now and will continue to work. When improvements are demonstrated, they are incorporated in the NO-OX-ID Master Coat. Therefore, the NO-OX-ID Master Coat of today is not the same as a few years ago or a few years hence, but it always will be the most advanced in perfection of any pipe line coat available at any time. Think this over and make use of the opportunity it offers you for increased effectiveness and longer life in pipe line protection.

Dearborn Chemical Company

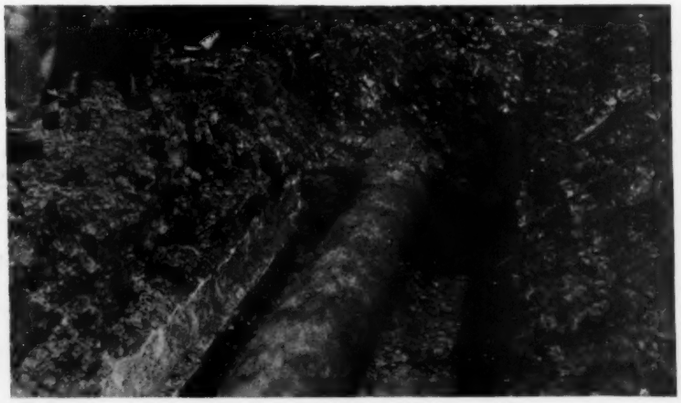
"A House of Chemical Engineers" In Its Forty-fourth Year of Service to Industry

310 South Michigan Ave., Chicago **807 Mateo St., Los Angeles** **205 East 42nd St., New York**

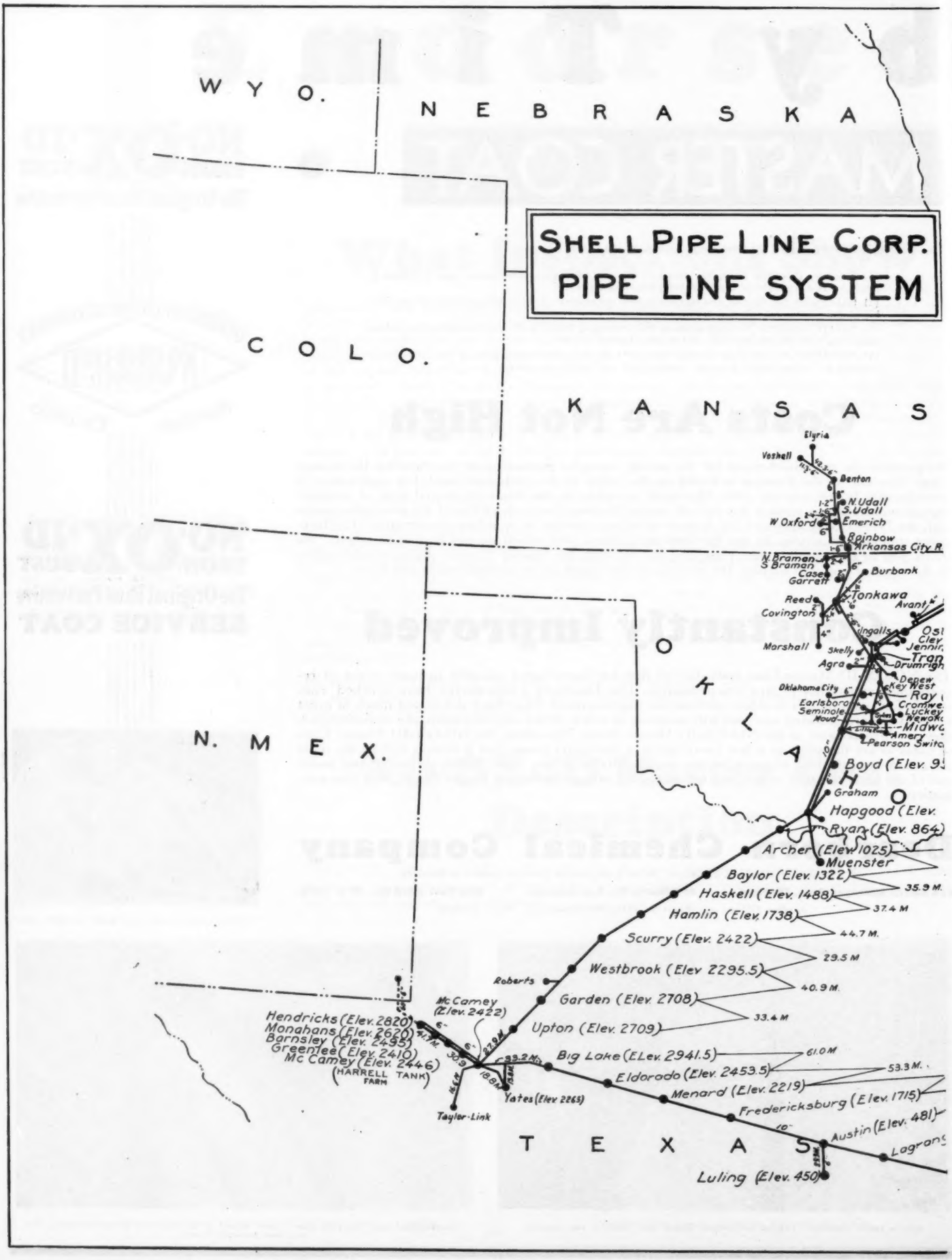
Canadian Offices and Factory: 2454-2464 Dundas St., West, Toronto

Testing coatings in prepared highly corrosive bed.

"Line in perfect condition." Exposed test surfaces showed that protection was complete.



Reconditioned job. Inspection after 3 years showed all pits dead and no new corrosion. Has now been protected 9 years.


SHELL PIPE LINE CORP.
PIPE LINE SYSTEM
WYO.
NEBRASKA
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KANSAS
OKLA.
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Elyria
Vosholl
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Rainbow
Arkansas City R.
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S. Braman
Case
Garrett
Burbank
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Covington
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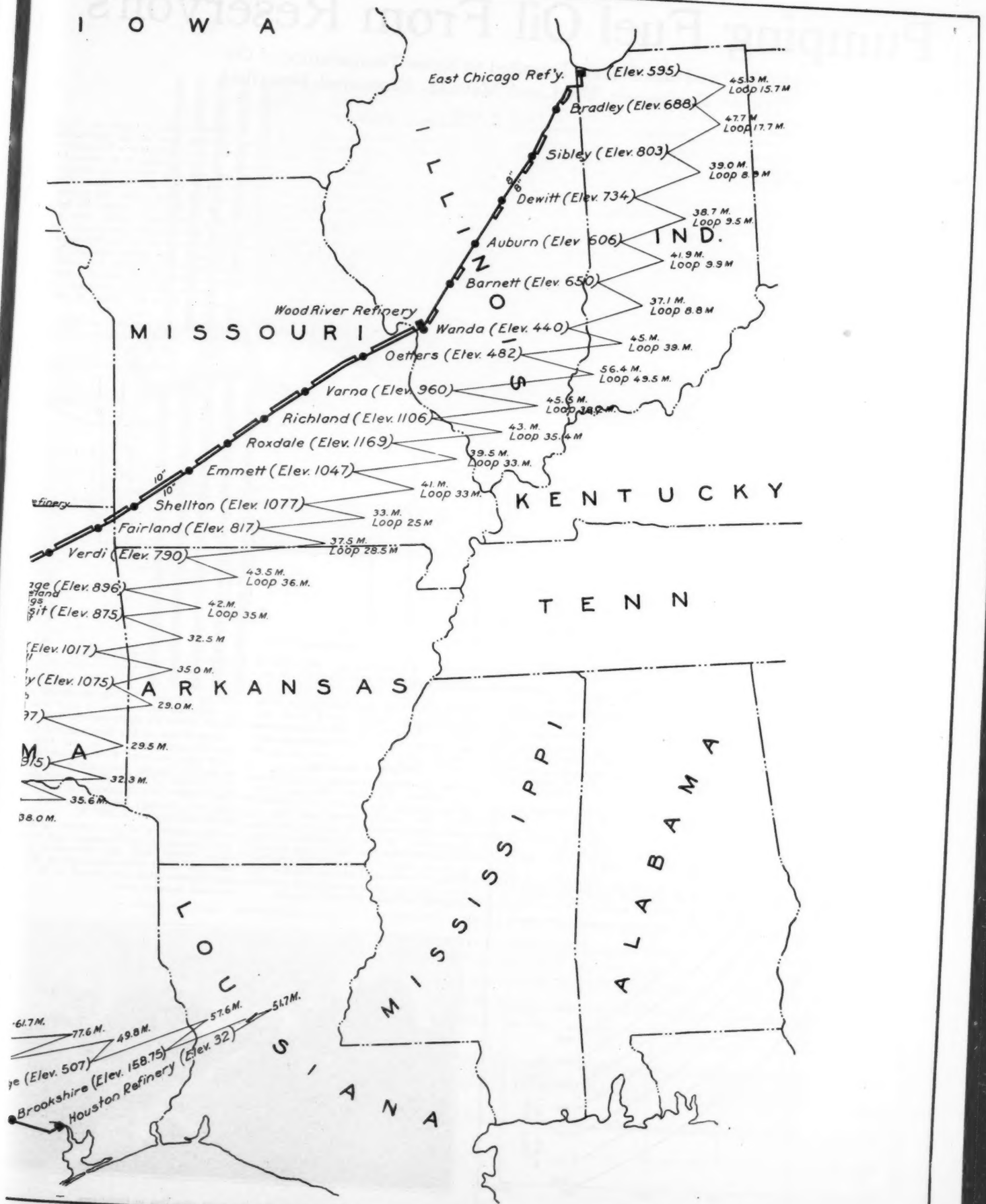
Marshall
Skelly
Agra
Drumright
Depew
Key West
Oklahoma City
Earlsboro
Seminole
Ray
Cromwell
Luckey
Newkirk
Midway
Amery
Pearson Switch
Boyd (Elev. 9
Graham
Hapgood (Elev.
Ryan (Elev. 864)
Archer (Elev. 1025)
Muenster
Baylor (Elev. 1322)
Haskell (Elev. 1488)
35.9 M.
Hamlin (Elev. 1738)
37.4 M
Scurry (Elev. 2422)
44.7 M.
Westbrook (Elev. 2295.5)
29.5 M
Roberts
Garden (Elev. 2708)
40.9 M.
McCamey (Elev. 2422)
Upton (Elev. 2709)
33.4 M
Hendricks (Elev. 2820)
Monahans (Elev. 2620)
Barnsley (Elev. 2495)
Greenlee (Elev. 2410)
McCamey (Elev. 2446)
(HARRELL TANK FARM)
Big Lake (Elev. 2941.5)
61.0 M
Eldorado (Elev. 2453.5)
53.3 M.
Menard (Elev. 2219)
Fredericksburg (Elev. 1715)
Austin (Elev. 481)
Lagrang
Yates (Elev. 2265)
Taylor-Link
Luling (Elev. 450)


I O W A
East Chicago Ref'y. (Elev. 595)
45.3 M. Loop 15.7 M
Bradley (Elev. 688)
47.7 M Loop 17.7 M.
Sibley (Elev. 803)
39.0 M. Loop 8.9 M
Dewitt (Elev. 734)
38.7 M. Loop 9.5 M.
Auburn (Elev 606)
41.9 M. Loop 9.9 M
Barnett (Elev. 650)
37.1 M. Loop 8.8 M
Wood River Refinery
Wanda (Elev. 440)
45. M. Loop 39. M.
Oetters (Elev. 482)
56.4 M. Loop 49.5 M.
Varna (Elev. 960)
45.5 M. Loop 38.2 M.
Richland (Elev. 1106)
43. M. Loop 35.4 M
Roxdale (Elev. 1169)
39.5 M. Loop 33. M.
Emmett (Elev. 1047)
41. M. Loop 33 M.
Shellton (Elev. 1077)
33. M. Loop 25 M
Fairland (Elev. 817)
37.5 M. Loop 28.5 M
Verdi (Elev. 790)
43.5 M. Loop 36. M.
42. M. Loop 35 M.
32.5 M
35.0 M.
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29.5 M.
32.3 M.
35.6 M.
38.0 M.
ILLINOIS
IND.
MISSOURI
KENTUCKY
TENN
ARKANSAS
MISSISSIPPI
ALABAMA
LOUISIANA
61.7 M.
77.6 M.
49.8 M.
57.6 M.
54.7 M.
Brookshire (Elev. 158.75)
Houston Refinery (Elev. 32)

Pumping Fuel Oil From Reservoirs

Direct Fired Gas Heater Installed to Raise Temperature of Oil. Type of Equipment Used and Methods Employed Described

By Harold H. Yackey
Mechanical Engineer Transportation Dept., Union Oil Co. of California*

In 1929, it became necessary for the Union Oil Co. of California to draw upon the fuel oil in the five reservoirs at the Wilmington tank farm. These reservoirs are each of 750,000 bbls. capacity and were filled with fuel oil from 16.5 to 18.5 A.P.I. gravity.

A concrete pit 36 feet long by 12 feet wide, with the bottom approximately 3 feet below the bottom of the reservoir, was constructed at each reservoir. A motor-driven centrifugal pump was set in this pit and connected through a 10-inch line to a motor-driven centrifugal shipping pump. This pit pump with its electric control equipment was moved from reservoir to reservoir as each was emptied. The shipping pump discharged at various pressures, depending upon the point of delivery of the oil.

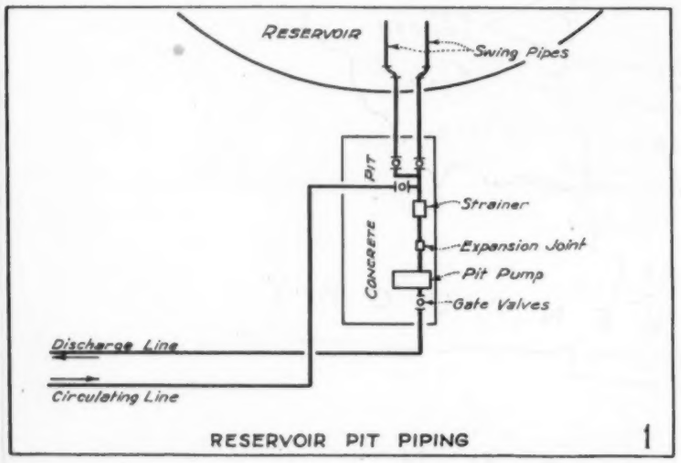
In order to reduce the viscosity of the oil in the pipe line, arrangements were made to inject hot oil into the reservoir drain pipes just outside of the main gate valve. As sketch No. 1 shows, a strainer was placed in the line between the hot oil inlet and the pit pump. This strainer removed the debris and helped to mix the hot and cold oil.

Direct Fired Heater Used

A direct fired gas-burning tubular heater was installed in a protected area near the shipping pump location. Oil was taken from the pit pump discharge line and pumped by two duplex power pumps through the heater and through a 6-inch circulating line into the cold oil line in the reservoir pump pit. The circulating line was buried to prevent unnecessary heat loss.

In determining the most economical pumping rate, the cost of maintaining an operating crew was balanced against power cost. The capacity of the system was limited by the rate the oil flowed through the reservoir drain pipes. The rate varied with the height of the oil in the reservoir, but averaged about 1,120 bbls. per hour until the oil was drained below the 7-foot level. The swing pipes were arranged to drain the heavy oil from the bottom of the reservoir first while the full liquid height was available to charge the pit pump.

The average temperature of oil in the reservoirs was 65° F. and the heater was designed to furnish enough heat to raise the shipping stream to 150° F. when pumping 1,500 bbls. per hour. This set the heater capacity at 18,000,000 B.t.u. per hour. When the circulated oil was dry enough to permit, a heater temperature of 400° F. was maintained. For the average shipping rate of 1,120 bbls., it was then necessary to circulate 314 bbls. per hour through the heater. As the oil became wetter, it was necessary to reduce the heater outlet temperature and increase the flow rate through the circulating system. Chart No. 2 shows the amount of circulated oil necessary for any heater outlet temperature at any shipping rate.



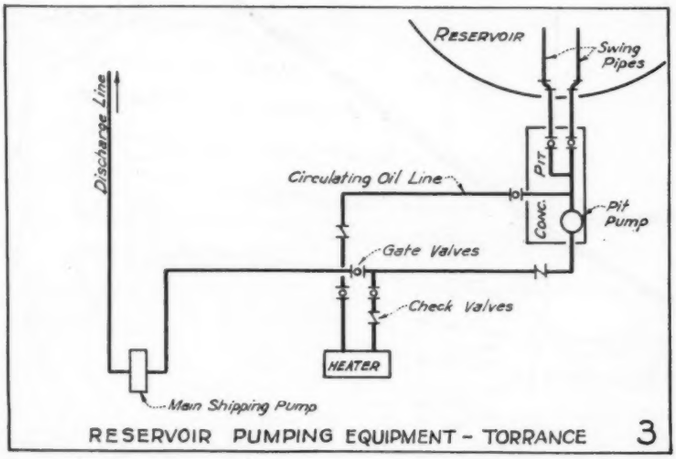
RESERVOIR PIT PIPING 1

Method of Operation

The system was operated in the following manner: The main discharge valve of the system was closed; the reservoir drain line valves opened and the pit pump and circulating pumps started. This started the oil circulating through the heater which was lighted and brought up to the desired operating temperature. When this temperature was reached the main shipping pump was started and the shipping line valve gradually opened.

A somewhat different pumping installation is being used at the 4,000,000-bbl. reservoir at the company's Torrance tank farm. The pit pump is a motor-driven turbine type deep well pump and is installed in a riser at the outer ends of the reservoir drain pipes. As shown on sketch No. 3, this pump discharges through a line which passes near a direct fired heater before going some 1,000 feet to the motor-driven centrifugal shipping pump. A gate valve installed in the line at the heater builds up sufficient pressure to by-pass any required amount of oil through the heater and back into the reservoir drain line ahead of the pit pump.

The oil in this reservoir is clean and free from water. This obviates the necessity for strainer cleaning shutdowns and the difficulty experienced by poor mixing of oils in the pit pump suction line.

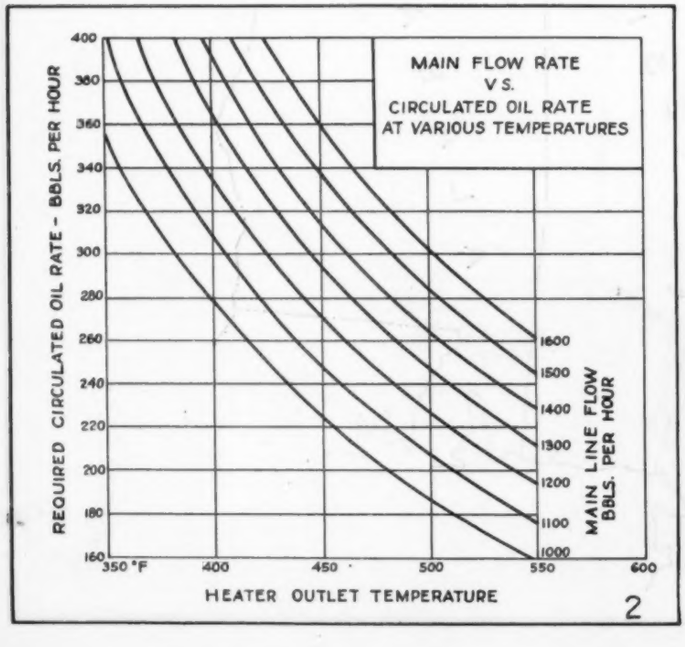


RESERVOIR PUMPING EQUIPMENT - TORRANCE 3

Most of the oil has been pumped from the Torrance reservoir at the rate of 1,100 bbls. per hour. With a temperature of 64° F. in the reservoir, a shipping temperature of 120° F. is maintained. This requires the circulation of 210 bbls. per hour through the heater when the outlet temperature is 400° F.

The operation of the systems at both the Wilmington and Torrance tank farms agree closely with the theoretical heat and pipe line friction calculations. These installations also were found to be economical in operation.

*Prepared under direction of Fritz Karge, engineer of transportation.



2

Tieing in welded joints on an oil pipe line in Oklahoma.

Six 40-foot lengths of 14-inch Naylor SPIRALWELD Pipe suspended six feet above skids to demonstrate its strength and flexibility. Gas line in Texas.

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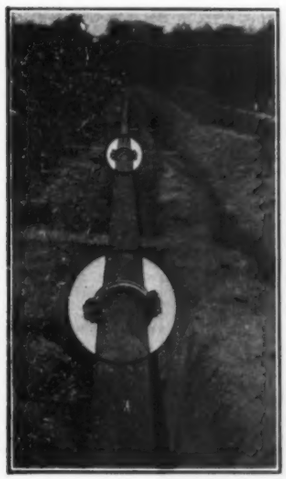

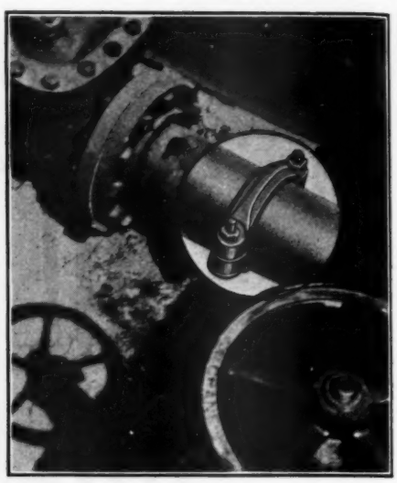

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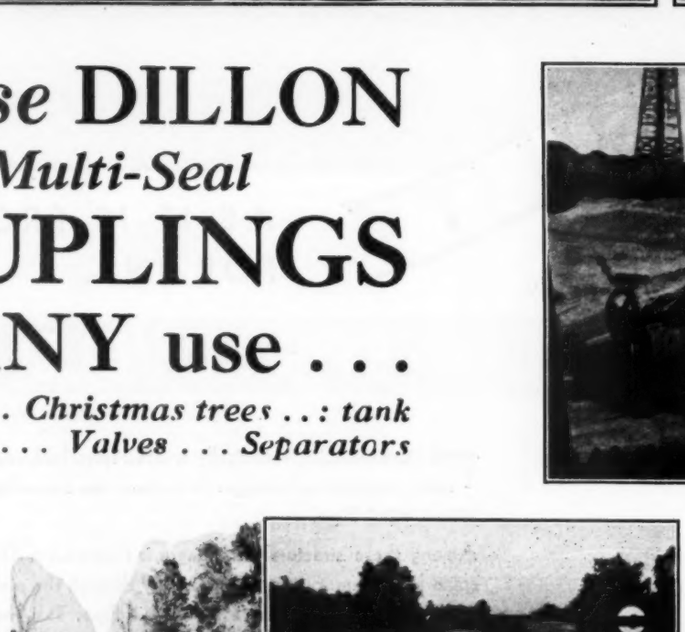

The picture to the left (where the workmen are) shows a 6″ oil line being laid in the East Texas Field. Record time was made here under severe working conditions, including rain, slush and mud.

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Austin Busy on Iraq Pipe Line Plans

Early Beginning of Construction Expected but Completion May Not Be Realized for Two or Three Years at Earliest

By A. E. Mockler
New York Bureau, The Oil and Gas Journal

Definite plans for construction of the Iraq pipe line, generally regarded as the major foreign oil pipe line project to date, have been made and early construction of the line will get under way, according to reports from abroad. American interests identified with the Iraq Petroleum Co., which holds the grant for the exploitation of Iraqian oil fields, are being represented in connection with pipe line plans by H. S. Austin, president of the Ajax Pipe Line Co., and former head of the Tuscarora Pipe Line Co., who has been in Mesopotamia for several months on behalf of the Standard Oil Co. (New Jersey), Atlantic Refining Co., Gulf Oil Corp., Stanolind Oil Co. of New York, and Pan American Petroleum & Transport Co. (Standard Oil Co. of Indiana), who represent the American interest in the Iraq project.

Details surrounding plans for the Iraq line have not yet been made public, although it is known that the line, when completed, will have capacity for running approximately 85,000 bbls. of crude per day, and that the line will have two terminals.

Construction of the Iraq line has been held back for several years as a result of the inability of the British and French interests in Iraq petroleum to reach an agreement as to where the line would terminate. The British interests insistently held out for construction of the line to Haifa, which is under British jurisdiction, while the French were just as insistent that the line should reach tidewater at a point in their control. The matter was finally settled by a decision to construct a bifurcated pipe line system, one end terminating at Haifa (British control) and the other branch reaching the Mediterranean at Tripoli.

According to reports from Mesopotamia, an agreement has been reached between the Iraq government and the Iraq Petroleum Co. providing for the construction of a bifurcated pipe line system from Iraq, and with this agreement definitely in hand, it is not believed that construction work will be much longer delayed.

Will Affect World Market

Completion of the Iraq pipe line project will make for intensified competition in world petroleum markets, and will have a particularly important bearing upon exports of United States petroleum and products to France, as the latter country, which is now building up an extensive home refining industry, plans ultimately to draw the great bulk of its crude petroleum requirements from Iraq.

The Iraq Petroleum Co. is under the joint control of American, British, Dutch and French oil interests, each of which controls a 23¾ per cent interest in the company. The remaining 5 per cent is held by Sarkis Gulbenkian, an Armenian financier, who originally secured the concession for exploitation of Iraq's oil deposits.

Major American, British and Dutch interests involved in the Iraq project have been endeavoring for some years to delay exploitation of the oil deposits in that country in view of the present world oversupply of petroleum. Some measure of success attended these efforts until last year when the Iraq government began to press for the early development of its oil resources, and the French interest in the company likewise became insistent that development work go forward without additional delay, France desiring to secure a steady supply of Iraqian crude as quickly as possible to supply her new refining industry, which has been projected with government support as a national defense measure.

Although plans for early start of construction are reported to have approved, and surveying work is now going forward, construction of the Iraq line, in the opinion of pipe line engineers, will be a difficult feat and the project will take considerable time before the lines are ready to run Iraq crude to seaboard. The projected route of the line traverses exceedingly difficult terrain at many points, and other difficulties, aside from those presented by the nature of the territory to be crossed, will have to be overcome.

Survey Under Guard

The territory which the two branches of the Iraq line will traverse is nominally pacified, but strong military patrols are still kept in the field by both the British and the French. The first survey work on the Iraq line was started in August of last year. The group of engineers in charge of the work examined several stretches of the Syrian Coast, and made an air reconnaissance in French military planes across the Syrian Desert, passing over Tikrit and Mosul. The field force then moved from Beirut, under armored car escort, via Palmyra to Abu Kemal and Ana and surveyed the ground between Rawa, Tikrit and Tuz Khurmatli, returning thence to Haditha and continuing their survey on to Ruthba and along the Wadi Haurin under escort of the Royal Air Force. A further aerial survey was made to Qasr Azrak and Amman, and the party continued on to Jerusalem, Haifa and Beirut, completing its survey early in December. At last reports, the route of the line had been definitely decided on, with the exception of the point at which the line will cross the River Tigris.

No announcement has been made yet as to who will build the Iraq line, but it is expected that American engineers will play a prominent part in the construction, as the technique of pipe line construction is further advanced in this country than elsewhere, and American pipe line engineers have had a greater degree of experience in major pipe line construction projects of this kind.

Iraq Petroleum Co., however, has met with considerable success in training native workmen for the various types of labor necessary in pipe line construction work, and it is expected that native employes of the company will handle the actual labor of construction of the new line. Iraq Petroleum has constructed extensive modern workshops at Sulaiman Beg, including a power house, machine and erecting shop, smithy and boiler shop, power station, oxygen-making plant and a dissolved acetylene plant, and has made good progress in training Iraq laborers in the various trades connected with the company's activities, under the operations of an apprenticeship plan for young Iraqis put into effect in December, 1929.

Completion in Three Years

While the decision to go forward with the Iraq line has hastened the day when Iraqian crude will become a major factor in the world's petroleum markets, it is not believed that crude from the Mosul fields will begin to reach the world's markets within two years, at the inside, with most estimates placing the period of time before final completion of the pipe line system at two and one-half to three years.

Considerable exploration work has been carried forward in the Mosul fields by Iraq Petroleum Co., and while few reports of the potential production of Mosul have been made, it is generally believed the oil deposits of this territory constitute a huge reserve, and that the Mosul area in time will become one of the world's major producing fields. Test wells already completed and now shut in indicate a potential production of 100,000 bbls. per day or more, with additional drilling largely restricted pending completion of the pipe line which will move the oil to seaboard. Again, in connection with the possible difficulties to be met in construction of the pipe line over the desert to the Mediterranean, it is interesting to note that the test wells already completed and shut in in Iraq have heavy concrete covers over the well heads to protect the wells from vandalism.

The decision of the companies making up the Iraq Petroleum Co. to go forward with construction of the pipe line from the fields to the Mediterranean, it is believed, has effectively disposed of the possibility that the Iraqian government would restrict the operations of the Iraq company and would grant exploitation rights to another international group, which late in 1930 was reported in process of formation. The concessions now held by Iraq Petroleum Co. consist of 24 areas, each of 8 square miles.

Opposition Company

British Oil Development Co. was reported late in 1930 to be negotiating with King Feisal for development concessions in the Mosul fields. The company sought a concession similar to that held by Iraq Petroleum Co., and promised that, if granted the desired concessions, it would immediately build both a pipe line and a railway from the oil fields to the Mediterranean. Italian, German, French and Swiss interests were reported to be allied with the British Oil Development Co., which is headed by Lord Wester Wemyss. While British Oil Development Co. at one time was reported to be making headway in its efforts to enter Iraq on an equal footing with Iraq Petroleum Co., its project has apparently since been dropped, as nothing further has been heard of any negotiations and the Iraq government is apparently satisfied with the progress which Iraq Petroleum Co. is now making.

Besides the American companies previously mentioned as participants in Iraq Petroleum Co.'s operations, other companies holding an interest in the Iraq company include D'Arcy Exploration Co., Anglo-Saxon Petroleum Co., Ltd. (Royal Dutch-Shell); Compagnie Francaise des Petroles, and Near East Development Corp., the latter being the holding company jointly controlled by the five American companies interested.

A rocky stretch along the Southern Natural Gas Co.'s line to Birmingham.

Performance of Centrifugal Pumps

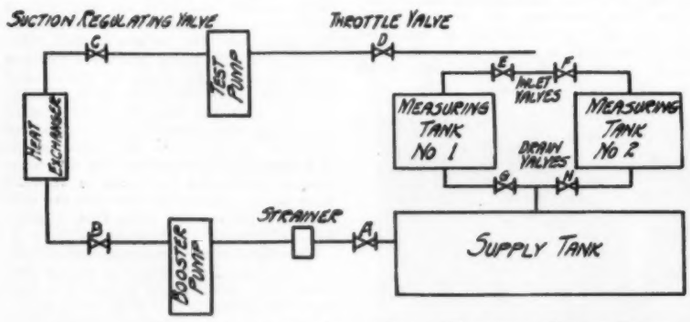
To Be Exactly Fitted for Oil Pipe Line Service, Pumps Must Be Tested Accurately for Performance With Oil

By V. de P. Gerbereux
Sales Engineer, Worthington Pump & Machinery Corp.

To effect the greatest possible economies in the use of centrifugal pumps for pipe line service, it is necessary to fit the units exactly to the requirements of the pipe line. Pipe line engineers have worked out these requirements with great accuracy, and it has become necessary for the pump manufacturers to employ equal accuracy in watching their centrifugal pumps to meet these conditions.

Many attempts have been made to predict the performance of an oil line centrifugal pump on calculations based on performance with water. This practice has proved itself to be far too inaccurate and undependable. To be exactly fitted for oil pipe line service, centrifugal pumps must be tested for performance with oil. These tests must be made with a thorough knowledge of the real service conditions to be met, and absolute accuracy must be obtained. In general, the Standard Test Code of the American Society of Mechanical Engineers is followed, although the fact that oil is the pumping medium will require special precautions not covered by this code.

The apparatus for such tests will not be the same as for the standard water pump tests. Special care must be taken to duplicate actual field conditions. Figure 1 shows the type of tesing apparatus that generally is considered to give the most accurate results.



TYPICAL SET UP FOR TESTING CENTRIFUGAL PUMPS ON OIL
FIGURE 1

The supply tank must be of sufficient size to permit the returned oil to settle and also to relieve foaming. As the oil is continually recirculated during a test, it will become heated. Unless the supply tank is sufficiently large, this heating will be so rapid that inaccuracies in the test will result. The tank should hold about 15 to 30 minutes' supply for the test pump.

A strainer should be placed in the line between the supply tank and the booster pump. This will prevent any foreign material which might get into the system from passing into the test pump and thus affect its performance.

Booster Pump and Heat Exchanger

A booster pump should be used to permit variation in the suction conditions of the test pump. Without the booster, it would be necessary to elevate the supply tank 50 feet or more to obtain one of the most common of pipe line conditions, 20 to 25 pounds pressure on the suction. By using the booster pump and a throttle valve, the suction pressure on the test pump can be varied from 40 pounds to a vacuum as desired and the supply tank need be elevated only a few feet. The booster pump can be a standard single stage volute centrifugal pump.

The heat exchanger is one of the most important parts of an accurate oil test stand. It is well known that the viscosity and specific gravity of any oil will vary with the temperature of the oil. A continued test, with half hour runs at each point, may take several hours, and the temperature of the oil supply may vary considerably during this time. This may be due to atmospheric conditions as well as to the fact that continuous recirculation causes the oil to become heated. By means of the heat exchanger, the oil going to the test pump can be maintained at a practically constant temperature for long periods of time.

If it is desired to run tests at various viscosities, the heat exchanger can be so regulated to give any reasonable degree of viscosity. The oil chosen for testing must have the necessary characteristics to permit this regulation by control of the temperature. The heat exchanger should be equipped not only to cool the oil, but also to heat it, and should be able to maintain any constant temperature between 50° and 250° F.

The test pump may be any centrifugal pump, although the layout illustrated here is primarily intended for testing oil pipe line pumps. The piping leading to the test pump should be oversize. The reduction to the diameter of the pump suction opening (which should take place six diameters from the suction flange) should be installed without causing "high spots" or eddy currents. As the discharge pressure of the pump will be more than 300 pounds, and the only load on the pump is the friction of the system, this pressure must be "killed" by use of a throttle valve. The discharge pipe should remain full size for a distance of 10 to 12 diameters beyond the range—it then may be reduced to secure the necessary throttling action. The valve in the discharge line may be somewhat smaller than is indicated by the size of the pump discharge opening and, as this is a high pressure valve, the adjustment to any fixed position then will become simpler and more accurate. For example, a 6-inch valve with a pressure of 400 pounds upon it requires about four times as much effort to set as would a 3-inch valve. To prevent too great swirling and eddying and to maintain stream line flow, the reduction in area of the discharge pipe must be gradual. The increase to normal pipe size must be just as gradual.

Two Measuring Tanks

To facilitate handling a continuous test, two measuring tanks should be used. For convenience, these can be mounted above the supply tank, so that they can drain into it by gravity. If only one tank were used, the capacity of that tank would limit the length of the run. But with two tanks and an arrangement of quick-opening valves the length of the run is unlimited. The capacity of the tanks should be such that the changeover from one to another does not occur oftener than every three or four minutes even when testing the largest size pumps. These tanks must be carefully calibrated, and accurate floats or other convenient gauging device must be used.

The capacity measurement must be exact. It is common practice to use nozzles, Venturi meters and orifice meters for measuring capacity on water tests. For water, this practice is most accurate as the necessary velocity coefficients are high and unvarying, having been determined by repeated check tests.

For oil, it has been found that these coefficients vary with the velocity and, to a greater extent, with the viscosity. To obtain the degree of accuracy necessary for such tests as these, thousands of calibrations of each measuring device would be required and every variable influence included as part of the coefficient.

The simplest and most accurate method of measuring capacity is by direct displacement and the use of a good stop watch. This method is continuous when the two tanks previously mentioned are used. The test runs usually are made from a "flying start," that is, with the conditions set and one tank filling. While this tank fills, the inlet valve to the other is closed and the drain valve opened. When the second tank is practically empty, the drain valve is closed and an initial reading taken. When the first tank is nearly full, the inlet valve to the second tank is opened, and the inlet valve to the first tank is closed. In this way, the second tank is being filled while the first is full and at rest. The full reading on the first tank then is taken and its drain valve then opened. This can be repeated indefinitely and all of the oil pumped is accurately measured by displacement. To minimize a possible starting error, runs of half an hour on a point are made. Thus an error of 1 inch on the "flying start" reading would mean an error of less than one-tenth of 1 per cent in measurement.

Pressure Readings

Two pressure readings must be taken, one on the suction side and one on the discharge side of the test pump. These readings can be taken by standard pressure "test" gauges, although a combined pressure and vacuum gauge can be used on the suction, as can a gauge and mercury U-tube combination. Each of these gauges must be calibrated on a deadweight tester both before and after each run, and if the two calibrations do not closely agree, the gauge should be discarded and the test rerun for accuracy. Each gauge should be selected so that the average reading falls at about the center of the range of the gauge.

The gauges should be located not less than four diameters from the respective pump flanges. This will allow the flow lines to straighten out and become uniform, thereby eliminating erratic readings. The connection of the gauge to the pipe should be by the pressure belt method, Figure 3. This will eliminate false readings due to surges or wave action.

Because of the relatively high velocity in the discharge pipe, it often is desirable to use a damper to steady the hand of the gauge. To eliminate all air which would cause a false reading, the damper must be primed before using. A typical damper is shown in Figure 3.

The vertical distance from the center line of each gauge to the floor or other fixed horizontal datum should be accurately measured, and the difference between the suction and discharge gauge centers calculated. This value must be used in figuring the total dynamic head.

The inside diameters of both the suction and discharge pipes should be carefully measured at the point where the gauges are connected. This diameter is necessary for calculating the velocity heads at each point. The difference be-

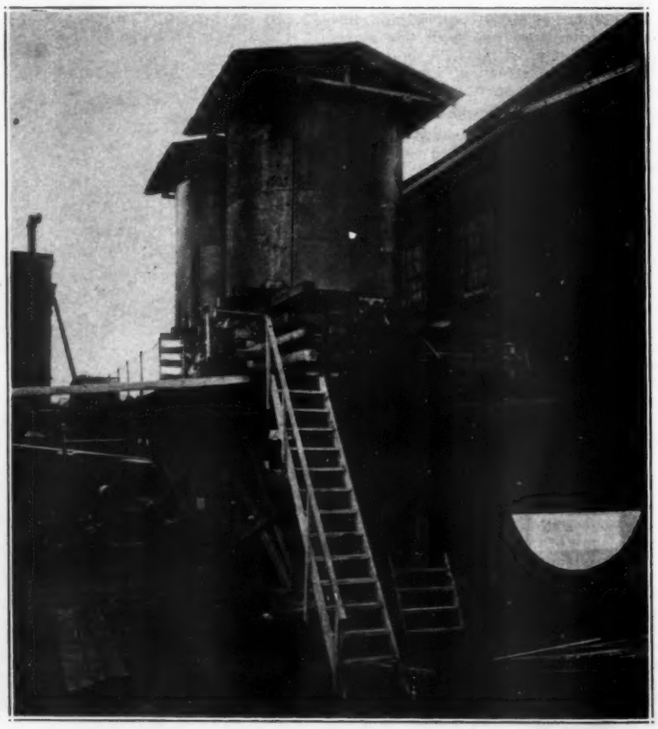
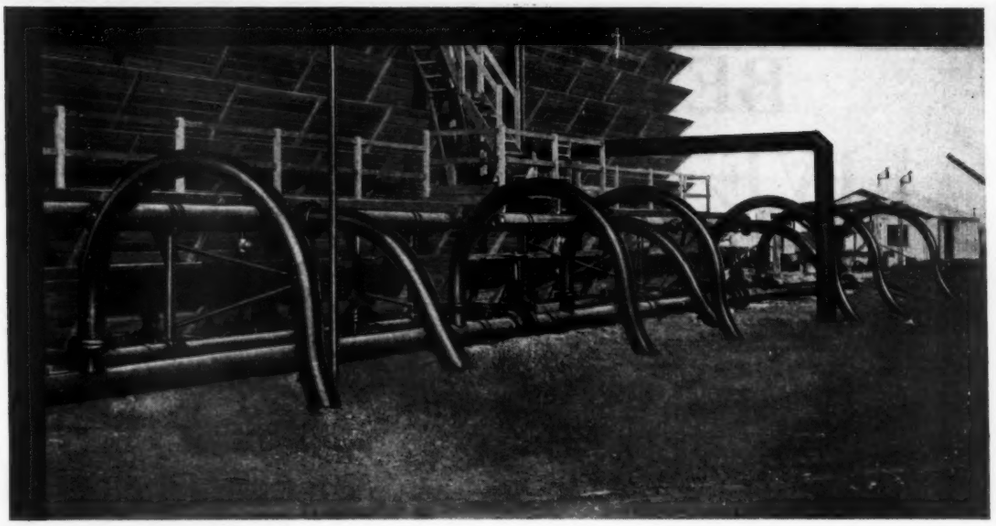


Figure 2—General view of test stand showing measuring tanks.



Midwest pipe bends on a 20-inch natural gas line

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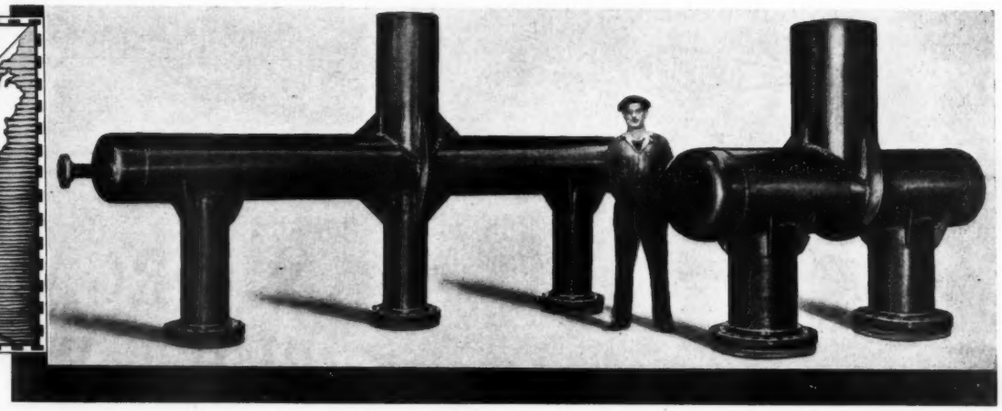

River crossing headers fabricated by Midwest

MUCH of the fabricated piping used in the pipe lines that now cover this country like a vast net, is the product of the four Midwest plants. There are a number of good reasons why pipe bends and welded headers for pumping stations, river crossings, etc. are so frequently fabricated by Midwest.

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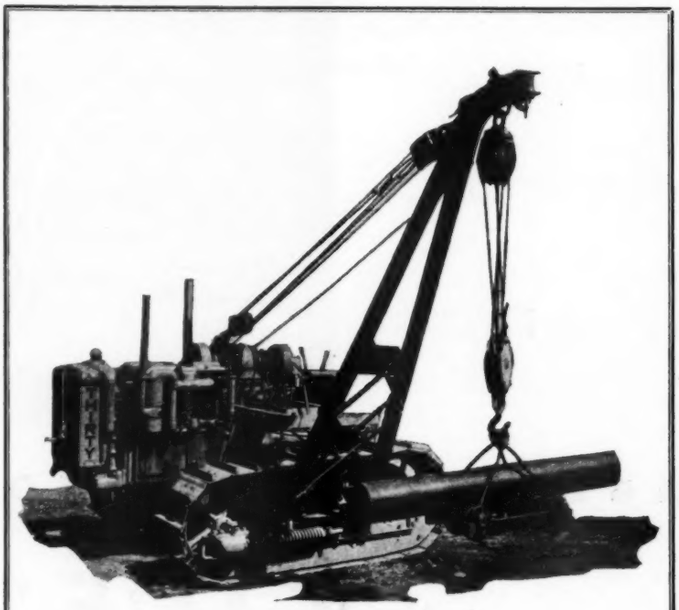

Berg Live Boom shown installed on "Caterpillar" Thirty

Sinclair 12" line, Oklahoma City, Okla., to Coffeyville, Kans.

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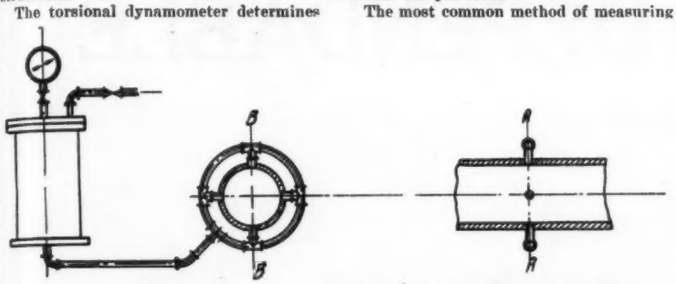
tween these heads is part of the total dynamic head.

Power Requirements

There are three generally used methods of determining the power requirements in testing centrifugal pumps. These are: The use of the torsional dynamometer; the electric dynamometer; and the calibrated electric motor with electrical instruments.

The torsional dynamometer determines



SECTION A-A - FIGURE 3 SECTION B-B
PRESSURE BELT AS USED FOR PRESSURE READINGS
SHOWING USE OF DAMPER

the torque required for power transmission through it by means of the twist of a rod. The value of the angle of twist is determined experimentally by a static test. In actual operation there is an error introduced by the bearing reactions of the machine which were not measured in the calibration. To secure the maximum angle of twist a light rod is used. This means that at high speeds (3,600 r.p.m.) the rod is operating above its critical speed, thus introducing whipping and increased bearing reactions. All of these seriously affect the accuracy of the reading. The method of reading usually is by means of a ray of light passing through a slot in one disc to a rotating scale-marked drum not under torque load, running close to another scale-marked drum attached to the torque rod. An instantaneous reading is taken by sighting through the slot, and the angle of twist measured in degrees. If an error of 10 minutes (one-sixth of a degree) occurs, we have an error equivalent to 5 to 6 per cent in the horsepower determination. Even with a vernier attachment, it is practically impossible to read more accurately than within 10 minutes. As it is necessary to read to at least three decimal places, and a deflection of only about 1 inch is obtained on the scale, it is difficult to obtain reasonable accuracy. For speeds of 1,200 to 1,500 r.p.m. and lower, the shaft avoids critical speeds and the torque deflection is greater. At these speeds, a torsional dynamometer can be said to be accurate within 1.5 per cent, but on tests at 3,600 r.p.m., even with compensating errors, its accuray can scarcely be within 3 to 4 per cent.

The electrical dynamometer determines the torque required by weighing the pull on a fixed arm on the stator. The stator is mounted on antifriction bearings and is free to rotate. The calibration of the weighing device is, of course, necessary. The greatest source of inaccuracy in this machine lies in the inertia of the stator and its resistance to motion. Tests have shown that a torque of 35 inch-pounds is required to overcome this inertia on a 50 horsepower dynamometer, or the equivalent of 4 per cent of its total torque. If the load is steady, this may not seriously affect the accuracy but it must be considered. The reactions on both rotor and stator bearings also introduce inaccuracies, particularly if there is a slight misalignment. If carefully used, an accuracy within 0.5 to 1 per cent can be obtained on this type of machine. But if care is not taken, the error may be as high as 2 to 3 per cent.

Electrical Instruments Best

The most accurate determination of horsepower is by the use of carefully calibrated electrical instruments and a carefully calibrated electric motor. The motor can be very accurately calibrated by the A.I.E.E. loss method which determines, with proved electrical instruments, the total losses in the machine, including the bearing reactions. The test readings, therefore, do not involve the errors which a rotating mechanism may introduce, and the accuracy of the readings is dependent only on the accuracy of the electrical ammeters, voltmeters and wattmeters. As these instruments are readily calibrated, operate on jeweled bearings and have a full 6-inch scale reading, the resultant power readings can be made accurate within 0.1 per cent.

The most common method of measuring speed (revolutions per minute) is by the hand revolution counter and a watch. If readings are taken over a full minute an experienced tester can obtain an accuracy within 0.5 per cent. The direct reading tachometer will not remain calibrated for a sufficient length of time to be accurate and should only be used for approximate or check readings.

The slip method of speed measurement is even more accurate than the revolution counter. In this method a rotating disc with alternate quarters of black and white is attached to the shaft of the pump or motor, and a small synchronous motor, on which is mounted a slotted disc, is placed in front of the disc on the shaft (see Figure 5). By sighting through the perforated disc the number of revolutions per minute of slip can be counted. As the synchronous motor speed will be determined by the use of a frequency meter, the difference between the two will be the pump speed.

The temperature of the oil should be taken just before it enters the pump. A calibrated thermometer placed in a thermometer well in the suction pipe several diameters from the pump suction flange will give this figure. A sample of the oil used for pumping should be taken before and after each test run and carefully analyzed at the pumping temperature. A Saybolt viscometer and standard A.P.I. hydrometer can be used for this analysis.

The calculation of the capacity from the tank readings is readily made. The total displacement in each tank filling can be read directly from the tank calibration table, and the sum of all the displacements during the run at any one point divided by the time in minutes gives the capacity in gallons per minute.

The difference between the suction pressure and discharge pressure readings constitutes the largest part of the total dynamic head. To this result must be added the difference in level of the center line of the gauges (if the suction gauge is higher, this is subtracted), and the difference in velocity heads in the suction and discharge lines. These last two readings are determined in feet, and must be converted to pounds per square inch by dividing by the constant 2.31, and multiplying by the specific gravity.

The calculation of horsepower input to the motor from the electrical instruments is a matter of applying the correct constants to these instruments and then calculating the actual kilowatts input by using the proper electrical formula and the power factor. The use of rotating standards and direct reading wattmeters gives a ready check on this calculation. The motor input times the motor efficiency will give the power input to the pump.

The pump efficiency can be calculated from the following formula:

$$\text{Efficiency} = \frac{\text{g.p.m.} \times \text{lbs. per sq. in.} \times \text{t.d.h.}}{1{,}715 \times \text{input horsepower}}$$

This formula is directly derived from the common horsepower relation, and offers a short-cut in calculation. The results can then be plotted on a curve. This graphic presentation of results makes it possible immediately to visualize the adaption of the pump to various service conditions.

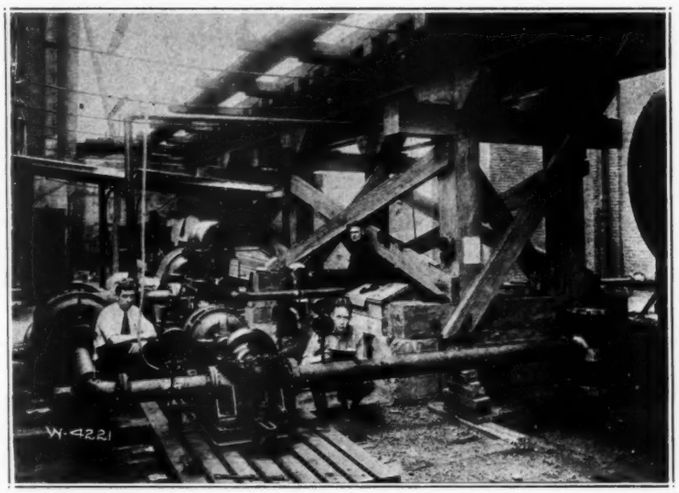


Figure 4.—Showing test pump, booster pump, heat exchangers and gauge connections.

Field Tests

Field tests conceivably could be made nearly as accurate as laboratory or shop tests. But it is obvious that, to make them so, would involve building a laboratory in the field. It is estimated that even extensive field tests under normal pipe line pumping conditions are never more accurate than within 3 to 5 per cent. The place to find out what a centrifugal pipe line pump can actually do is in the testing laboratory.

The importance to the pipe line industry of having such accurate testing of centrifugal oil line pumps is immeasurable. Accurate tests enable the pumps to be fitted more accurately to their jobs, which means less wasted power and lower operating costs. If a pump has been poorly fitted to its job and develops excess pressure, so that it must be throttled, there is a waste of power. Unless the test be absolutely accurate, there will be a tendency to "play safe" and give the pump too much pressure. As result, power is wasted.

Accurate tests further permit the use of an electric motor just powerful enough for the job. If the load requires 249 horsepower at the pump, a 250 horsepower motor only can be used safely if the pump has been accurately tested and matched to the pumping load. Inaccurate tests, regardless of results, probably wuold mean the overload of the 250 horsepower motor with its consequent deterioration, and possible burning out of its windings. The alternative would be to put in larger sized motors with an increased initial cost, lower motor efficiency, and higher connected load charge.

Accurate testing will further aid the industry by the complete elimination of faith in "paper guarantees," "water guarantees," and slip-shod test methods. The selection of equipment, the projected cost of operation and the very success of the pipe line itself are based on the pipe line engineer's acceptance of the pump manufacturer's guarantee. Unless this guarantee is based on real, honest, exact test data, the pipe line project itself may be unsuccessful.

The actual efficiency that can possibly be obtained at any one condition of head, capacity and speed is fairly well fixed. The internal pump losses due to disc friction, wall friction, internal leakage, conversion of velocity to pressure, bearings, etc., are nearly constant for the given condition. There is, therefore, a maximum possible efficiency to approach in each case. It is possible to cut internal leakage to a very minimum for a short period of time by using extremely close clearances, and by using a very small diameter shaft to get a reduced inlet loss at each impeller with high resulting efficiency. Such construction would mean a rapid falling off of performance in actual service and a failure to maintain even a reasonable efficiency.

The pipe line industry owes it to itself to insist on absolute accuracy in all tests of centrifugal oil pipe line pumps; to have all guarantees of performance substantiated by such tests; and to demand sufficient ruggedness of design that such performance will be maintained over long periods of continuous operation.

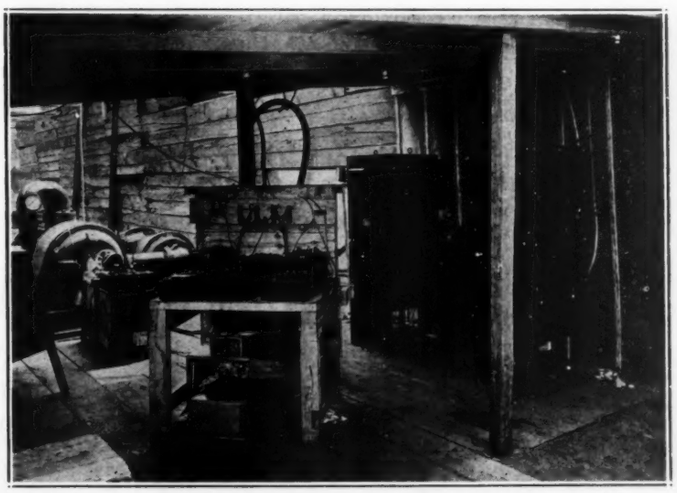


Figure 5—Showing electrical instruments.

LANDIS CUT THREADS are ACCURATE and DEPENDABLE

The oil industry has established a high standard for the threads of oil tubular goods. The threads must be *Dependable*—and *Dependability* means *Accuracy* in diameter, pitch, taper and thread form.

Landis cut threads are *Dependable*. This is indicated by the fact that Landis Pipe Threading and Cutting Machines are the first choice of oil men throughout the world.

In addition to its ability to produce accurate threads which are of vital importance in oil field work, the Landis Pipe Threading and Cutting Machine is *Versatile* and *Economical*. Thus a Landis Machine can be profitably installed in all field shops, both large and small.

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Field Problems and Their Solution

EDITED BY THOMAS F. SMILEY

In order that men connected with the drilling, producing and transporting branches of the petroleum industry may procure quickly a solution of many problems confronting them from time to time in their work, The Oil and Gas Journal has arranged with leading engineers and other recognized authorities to answer questions submitted by readers of this publication pertaining to the work of drilling and producing crude oil and transporting this product.

Everyone is invited to submit questions freely. These questions will be submitted to proper authorities by Mr. Smiley, who edits the page, and answers, based on the best available information, will be published. Each question should give as much detail as possible, especially where it relates to matters where depths of sands, types of sands and operations on adjoining properties would have a bearing on the problem involved. The source of all questions will be considered as confidential and only initials will be published in connection with the question.

In this connection, The Oil and Gas Journal will be glad to publish articles from field men who have devised new methods or practices which are improvements.

In case an immediate answer is important, one will be given by mail if the writer requests it.

OFFERED AN "OIL DIVINER"

Maybe you can set us straight. We are considering the drilling of a wildcat well close to a territory where we are fairly sure there is oil and gas in paying quantities, due to a well drilled in the past. We have been approached by a man who has an instrument with which he claims he can locate the oil. We have always been told there is no such animal, but he insists it is most accurate. He says that in a book published, "The Oil Conquest of the World," by F. A. Talbot, the instrument is recommended. Possibly you can give us some information about this instrument.—N. J. W.

"The Oil Conquest of the World," by Talbot, does speak in glowing language of the "oil diviner," as he calls it, and he shows a picture of it. The following concerning the diviner is quoted from the book:

"Oil beds are always covered with what may be described as a water blanket in the form of clays, shales, slates, and so on. These water-impregnated strata act as a vehicle for (electric) currents flowing in the earth and between the earth and the atmosphere, but the nonconducting oil beneath acts so powerfully and strangely upon the needle that its presence is recognized at once. This discovery was of the utmost importance and to test its reliability the apparatus was subjected to searching tests upon several fields. In every instance the correct spots for boring were quickly recorded and when drills were sunk the accuracy of the indication was proved. The success of these confirmatory experiments now enables oil prospectors to determine exactly where the well should be sunk. There is no further need to run trial borings upon the haphazard principle with the possibility of missing the oil. By making a detailed survey of the ground with the instrument uncertainty is converted into a certainty. It is not surprising to learn that the instrument has been adopted by several of the leading oil companies in various parts of the world."

This book was published in England in 1914. In the 17 years since then there has been plenty of opportunity for the oil diviner to demonstrate its worth and prove that Mr. Talbot's statements were not those of an overenthusiastic writer. It need not be pointed out that if this device really could do the amazing thing claimed for it there would be lively competition among the big oil companies for the right to use it. You haven't heard of any big rush for it, have you? At the office of the American Association of Petroleum Geologists the instrument had not been heard of.

Especially significant is the fact that "Applied Geophysics," an authoritative work published in London this year, does not mention the instrument, nor is one of the instruments included in the National Collections in the Science Museum, South Kensington, England, which is designed to show all geophysical devices of value. It seems safe to say that this oil diviner has gone the way of scores of similar devices for which big claims were made. It looks as though we shall have to worry along as best we can with the help of geologists and geophysicists, who do not even pretend to be able to find oil, but who do determine the location of underground structures favorable for the accumulation of oil.

KEEPING GAS WELL'S HISTORY

It is recognized as important to keep a drilling record of every oil and gas well, and some sort of record, not always as complete as it should be, is always kept, I suppose. What should a perfect record contain, please?—O. T. S.

The complete history of each individual well should be kept and studied much as a doctor has the nurse keep a chart to show the condition of his patient from hour to hour. Such a well record is of great value for study in connection with additional locations and in taking care of the well in subsequent years. J. French Robinson, geologist and engineer of the Hope Natural Gas Co., says a permanent record of each well drilled should contain the following:

(1) A record of each foot of the hole, stating whether it is coal, lime, sand, shale, etc. (2) Steel line measurements on all coal seams, lime horizons and the principal producing sands. (3) The sizes and quantity of the various strings of pipe in the hole. (4) Depth at which the hole was reduced. (5) Kind and size of packers and the depth at which they are set. (6) If a well is shot, give size of the shot and the depth. (7) Original volume and rock pressure. (8) Water, oil and gas should be recorded.

Comparison of any individual well log with a known type section of that vicinity makes it unnecessary to abandon a well until the last known producing horizon has been penetrated. Also the well log enables the driller to avoid the mistake of drilling beyond this horizon, as has been done in many cases, sometimes several hundred feet. No records are available today of thousands of wells in the United States; this omission represents a grave loss to the oil and gas industry. In many cases where wells are cleaned out and drilled deeper there is no information whatever as to where the holes were reduced, where the packers were set and where the various strings of pipe were run. It is needless to point out that operations under such conditions are uneconomical.

TESTING FOR CORROSION

It seems as though it should be possible to test the ability of any given piece of metal to resist corrosion without actually putting it into use. Why can't you take a sample of metal of the kind used in the pipe or the machine that you plan to use and subject it to the same, or approximately the same, corrosive conditions that it would have to meet in actual service? This should save not only a lot of time, but show you just what you will have to guard against. Has any plan of this kind ever been worked out?—D. T. H.

The idea you have in mind has been used and within certain limits it has been of practical help. The job of testing accurately for corrosion is rather one for the chemist, however, and the man unacquainted with laboratory work would not be likely to obtain accurate results. It must be remembered, too, that corrosive conditions change from time to time, and that the test made this year might not be an accurate guide next year.

Directions for making such a test as you describe are provided by Harry F. Perkins, technical director of the St. Louis Surfacer & Paint Co. You will recognize that laboratory equipment and a knowledge of chemicals should be possessed by the person undertaking to make a corrosion test according to these rules.

"The specific gravity of the metal under test must be known. A check sample of steel or other metal commonly used should always be employed.

"1. Clean surface of all scale and foreign material.

"2. Measure all exposed surface accurately in square centimeters.

"3. Weigh to fourth decimal point in grams.

"4. Suspend or support in corrosive medium at a point where the corrosive action will be as near as possible to that of actual service.

"5. Insulate samples electrically and maintain a clear spacing of 1 inch.

"6. Remove samples periodically (once a month) wash off mud, oil and loosely adhering corrosion products using as little force as possible. Dry quickly.

"7. When dry weigh carefully and examine for pits and scale.

"8. Replace in test.

"9. Final weighing should be made after every trace of corrosion products has been removed."

WHY WAS IT CALLED THAT?

DIAMOND DRILL

The diamond drill used in exploratory work preliminary to the development of an oil field is so called because the substance set in the head of the rotary boring device is a genuine diamond. True it is not the glittering white stone that sparkles from an engagement ring. On the contrary it is black, resembling a bit of coke, but it has the same chemical composition as its more elegant fellow, with the advantage that it is not so likely to break. These black diamonds, or "carbonados," are obtained chiefly in Brazil, though they are found too in some parts of this country. They will not take a fine polish and in their native state they range from microscopic minuteness to the size of a baseball.

FINDING EVAPORATION LOSS

What procedure is followed in ascertaining the volume of vapor escaping from a tank of oil or gasoline in order to know the evaporation loss? Is this the common method of finding out what the loss by evaporation is?—G. N. D.

There are four generally recognized methods for measuring the loss by evaporation from tanks or other containers. One is the method to which you evidently refer, although your question is not wholly clear. This method consists of measuring the actual loss by determining both the volume of vapors which escape from the system and the concentration of hydrocarbons in them.

Another is the vapor pressure method, the one most recently developed and probably the most accurate. It is described in The Oil and Gas Journal of November 13, 1930, in a paper prepared by George W. Chenicek and Walter G. Whitman of the Standard Oil Co. (Indiana) refinery laboratory in Whiting, Ind. The third method involves measurement of the amount of stock before and after the loss has occurred. This usually is done by gauging for volumes and correcting for temperature. The fourth method lies in determining some property of the oil which changes as evaporation goes on, as for instance, gravity, distillation or vapor pressure.

Losses from a tank or other container can be measured directly by determining the volume of vapors escaping and analyzing these vapors or suitable samples for hydrocarbon content. The volume can be obtained by several means, such as a dry meter, an orifice, or a calibrated breather bag. For the special case of loss measurement during rapid filling with ordinary gasoline, figures can be roughly estimated by merely assuming the gas displaced to be equal to the volume of liquid introduced.

Several analytical methods have been used on the vapors, the most common being absorption in mineral seal oil or charcoal and condensation with carbon dioxide and ether. The results by the different methods will vary, as is recognized from experience in estimating the gasoline content of natural gas. Specific gravities of the vapors can be employed as a quick method if the relation between gravity and hydrocarbon content for a given gasoline is established independently. The best results undoubtedly would be achieved by fractional analysis of the vapor, but the technique of the analysis is too slow to employ it for a large number of samples.

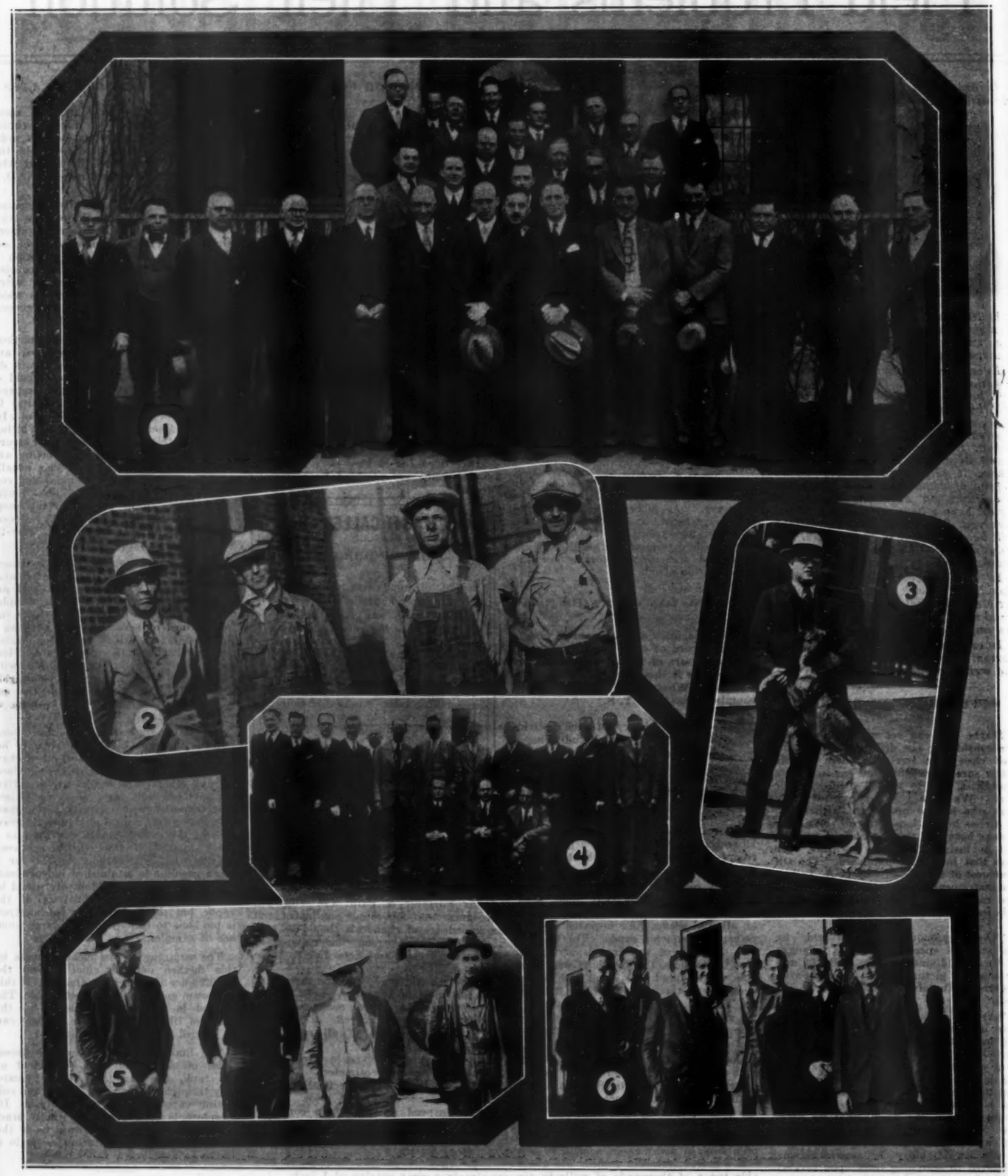
The accuracy of loss measurements by this method depends chiefly upon the significance of the vapor analysis. If this is known, good results are attainable. The method is particularly adapted to the study of filling losses where the test can be carried out near the refinery.

The limitations arise from the necessities of setting up test equipment at the tank, insuring that vapors escape only through the metering device, and collecting vapor samples for analysis. It, therefore, is not regarded as wholly practicable for field work away from the laboratory or for evaporation losses in a system which is not vapor-tight.

"HYDROFLUORIC" WAS MEANT

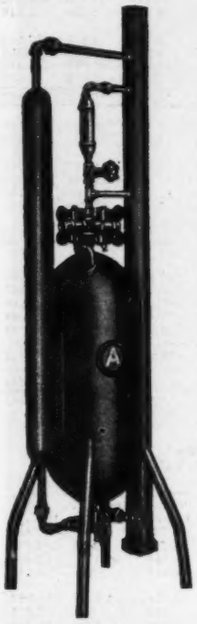
In the answer to a question by F. E. T. in the issue of May 21 regarding a method of determining the crookedness of a hole the bottle method was recommended, but through an error it was said that the bottle should contain hydrochloric acid. It should have read "hydrofluoric."

Men Active in Refinery and Pipe Line Branches



1—Lubrication engineers of Associated Oil Company. Front row, left to right: D. T. Owens, L. M. Edelman, J. A. Harris, F. D. Stevens, H. A. Shawk, chief lubrication engineer; H. H. Frazer, E. B. Montgomery, manager of lubricant sales; L. Mittleman, chief chemist; O. P. Cottrell, manufacturing manager; R. D. Sollars, F. W. Barrett, M. E. Storrs, C. A. Parks and W. H. Clausnitzer. Rear row, left to right: R. F. Betz, H. H. Lage, P. C. Becker, K. Robertson, R. J. Burdick, A. J. Rich, J. P. Harder, Warren Budd, E. W. Crosby, P. K. Clark, C. J. Brooks, H. Y. Hyde, superintendent research and development; A. R. Thrash, W. P. Hugo, general superintendent, Avon refinery; W. J. Bell and S. H. Bunting. 2—D. D. Greenwell, master mechanic; Leslie Reed, chief engineer; C. E. Holt, engineer, and E. R. Hester, engineer, Great Lakes Pipe Line Company, Ponca City, Okla. 3—C. H. Fox, superintendent, Producers Oil Company's refinery, Bristow, Okla. 4—Sales staff of Associated Oil Company of Pacific Coast. Front row, left to right: Frank L. Wager, sales manager for Pacific Coast; George F. Herrman and J. M. Evans. Rear row, left to right: W. B. Koenig, C. W. Frazier, W. E. Smith, E. Kayser, C. P. Benn, R. D. Montell, R. I. Loudon, J. K. Brandenburg, C. G. Ruby, R. M. Ropp, A. H. Harding, J. J. Baldwin and D. E. Donald. 5—E. C. Wise, stillman; Jene Murphy, clerk; W. O. Leek, office manager; and Joe Sneed, fireman, Producers Oil Company's refinery, Bristow, Okla. 6—Members of the specialty department of Associated Oil Company. Left to right: J. T. Manis, F. W. Twining, V. A. Strom, W. E. Wilson, Esler Johnson, manager; Roy Wakefield, Emmet Curtin, G. A. Hill and George Gessner.

FOR PERFECT PERFORMANCE



American Steam Lubricator

AMERICAN STEAM LUBRICATOR

The new American Steam Lubricator affords capacity for more pressure and greater strength. Equipped with two sight feeds so that one may be used while changing broken glass if necessary, in the other.

With this lubricator connected to Steam Header at the boiler, lubrication of mud pumps, engines and boiler feed pumps is assured at all times. Capacity 12 gallons.

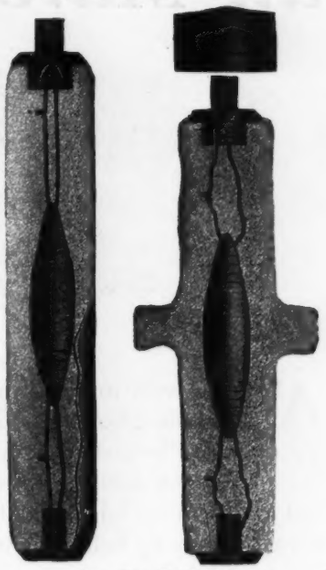
Why use four lubricators when the American will do the work of all?

AMERICAN LEAD PLUG

Tapered mandrel gives double expansion. Mandrel is made of cast iron and is therefore easily drilled out. The plug is made with rope socket neck to allow fishing same out in case it should be lost in pipe.

PLUG CAN BE MADE ANY SIZE

This plug has been used many times satisfactorily, where other plugs failed. It is profitable for it saves you time in your operations.



American Lead Plug

AMERICAN INSIDE PIPE CUTTER

If you have a stuck string of pipe, the American Inside Pipe Cutter is the tool to run for a cut of either liners, casing or drill pipe. For casing or drill pipe the Inside Pipe Cutter should be run to the bottom and a cut made and then an effort made to pull the full string. If this is impossible a cut may be made further up and an effort made to pull from that point.

The American Float Valve is made so that the interior may be milled out easily and the American Inside Pipe Cutter run the full depth of fish, without the use of an outside cutter.

It is considered a dangerous practice to run much 8″ Casing over 6″ Drill Pipe to wash down. If 8″ is twisted off the small clearance makes it almost impossible to fish out. With the American Inside Pipe Cutter it is not necessary to run any 8″ Casing.

Further details about how to use the American Inside Pipe Cutter with liners, casing or drill pipe will be cheerfully furnished.

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American Drill Pipe Float Joints
American Casing Suspender and Blowout Preventer
American Lead Plug
American Rock Bit Cone Fishing Sockets
American Steel Whipstocks
American Inside Pipe Cutter for Drill Pipe or Casing
American Adjustable Steel Rig Braces
American Fish Tail Bits
American Pipe Rackers
American Boltless Hose Clamp
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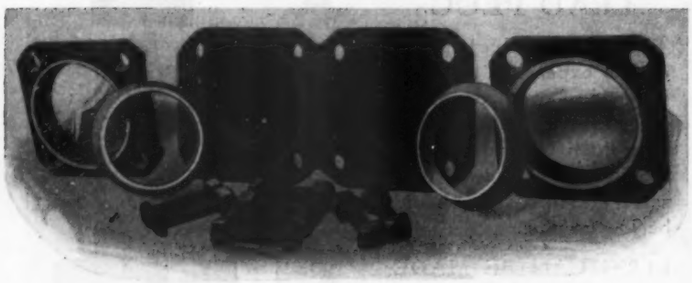
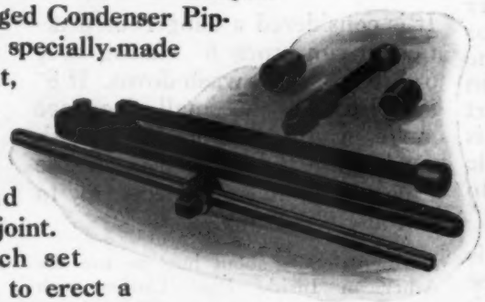
we *Furnish all Materials* . . .



ALL necessary materials inside the condenser box —including bolts, glands, gaskets and necessary spacers—are furnished with each order for Simplex coils. We also furnish complete erection drawing and bill of material. In addition, our engineers are always ready to help you with any problem of design or modification.

. . . *Including Tools*

With each initial order for Simplex Square-Flanged Condenser Piping comes a specially-made wrench set, consisting of ratchet, extensions, socket and universal joint. This wrench set enables you to erect a square-flanged Simplex condenser coil without any difficulty. These are small items, but they are a big help. They are like the new square-flanged design; it's a small change, but it permits a big space saving in coil construction . . . as high as 50% or even greater, depending on design of coil. Write for illustrated "SQUARE-FLANGED SIMPLEX CONDENSER PIPING" catalog.



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REPORT OF BUREAU OF MINES FOR THE MONTH OF MARCH, 1931

SUPPLY AND DEMAND OF ALL OILS
(Including wax, coke and asphalt in thousands of barrels of 42 U. S. gallons)

	Mar., 1931	Feb., 1931	Mar., 1930	Jan.-Mar., 1931	Jan.-Mar., 1930
NEW SUPPLY:					
Domestic product:					
Crude petroleum	69,397	60,645	77,600	196,033	231,564
Daily average	2,239	2,166	2,503	2,178	2,573
Natural gasoline	4,048	3,631	4,576	11,319	13,234
Benzol	194	172	262	550	731
Total production	73,639	64,448	82,438	208,402	245,529
Daily average	2,375	2,302	2,659	2,316	2,728
Imports:					
Crude petroleum	3,715	4,789	4,827	12,857	14,598
Refined products	4,065	2,917	3,713	10,583	10,742
Total new supply, all oils	81,419	72,154	90,978	231,842	270,870
Daily average	2,626	2,577	2,935	2,576	3,010
Increase in stocks, all oils	*2,048	*3,472	1,304	*9,833	11,515
DEMAND:					
Total demand	83,467	75,626	89,674	241,675	259,355
Daily average	2,692	2,701	2,893	2,685	2,882
Exports:					
Crude petroleum	1,586	1,710	1,944	5,215	5,483
Refined products	7,241	7,992	12,727	25,324	34,887
Domestic demand	74,640	65,924	75,003	211,136	218,985
Daily average	2,408	2,354	2,419	2,346	2,433
Excess of daily average domestic production over domestic demand	†33	†52	240	†30	295
STOCKS (end of month):					
Crude petroleum:					
East of California	357,663	361,887	386,157	357,663	386,157
California‡	141,547	142,093	152,124	141,547	152,124
Total crude	499,210	503,980	538,281	499,210	538,281
Natural gasoline at plants	884	692	673	884	673
Refined products	156,237	153,613	161,727	156,143	161,727
GRAND TOTAL STOCKS, ALL OILS	656,237	658,285	700,681	656,237	700,681
Days' supply	244	244	242	244	243
Bunker oil (included above in domestic demand)	3,666	3,632	4,077	10,832	12,365

*Decrease. †Deficiency. ‡Includes residual fuel oils.

COMPARATIVE ANALYSES
(Thousands of barrels of 42 U. S. gallons)

	Mar., 1931 Total	Mar., 1931 Daily av.	Feb., 1931 Total	Feb., 1931 Daily av.	Jan.-Mar., 1931	Jan.-Mar., 1930
CRUDE PETROLEUM:						
Runs to stills:						
Domestic	69,264	2,234	61,524	2,197	196,374	218,635
Foreign	4,332	140	3,725	133	12,497	14,194
Total	73,596	2,374	65,249	2,330	208,871	232,829
Imports	3,715	120	4,789	171	12,857	14,598
Exports	1,586	51	1,710	61	5,215	5,483
MOTOR FUEL:						
Production	35,246	1,137	31,328	1,119	99,282	108,330
Imports	1,607	52	948	34	3,671	3,401
Exports	2,946	95	3,606	129	11,455	16,703
Stocks*	48,225	....	45,355	....	48,225	55,239
Domestic demand	31,037	1,001	26,133	933	84,014	83,050
KEROSENE:						
Production	3,676	119	3,171	113	10,407	13,639
Imports	1	....	....	....	2	15
Exports	1,163	38	977	35	3,423	4,918
Stocks	6,300	....	6,477	....	6,300	8,455
Domestic demand	2,691	87	2,272	81	7,559	9,376
GAS OIL AND DISTILLATE FUELS:						
Production	8,730	282	8,697	239	23,261	18,895
Stocks	14,064	....	13,695	....	14,064	13,184
RESIDUAL FUEL OILS:						
Production	22,024	710	19,839	709	63,203	77,614
Stocks†	18,041	....	18,464	....	18,041	19,314
GAS OIL AND FUEL OIL:						
Production	30,754	992	26,536	948	86,464	96,509
Imports	2,449	79	1,956	70	6,876	7,163
Exports	2,260	73	2,555	91	7,795	9,743
Stocks	32,105	....	32,159	....	32,105	32,998
LUBRICANTS:						
Production	2,293	74	2,036	73	6,770	8,727
Imports	3	....	3	....	8	7
Exports	547	18	557	20	1,791	2,507
Stocks	10,710	....	10,911	....	10,710	9,561
Domestic demand	1,950	62	1,583	57	5,248	4,935
WAX (thousands of pounds):						
Production	37,520	1,210	38,640	1,380	118,720	164,640
Imports	1,289	42	3,035	108	6,969	6,451
Exports	30,470	983	23,502	839	76,036	71,163
Stocks	208,620	....	229,414	....	208,620	230,734
Domestic demand	29,133	940	21,802	779	73,625	58,786
COKE (short tons):						
Production	170,400	5,497	150,300	5,386	480,200	445,700
Stocks	1,089,100	....	1,052,600	....	1,089,100	785,600
ASPHALT (short tons):						
Production	190,200	6,135	165,300	5,921	503,300	632,200
Stocks	354,100	....	331,500	....	354,100	302,200
ROAD OIL:						
Production	114	4	115	4	331	775
Stocks	292	....	258	....	292	299
MISCELLANEOUS:						
Production	821	26	773	28	2,370	1,304
Stocks	774	....	678	....	774	510

*Includes motor fuel blends held at natural gasoline plants and in gasoline pipe line systems. †East of California.

INDICATED DOMESTIC DEMAND FOR CRUDE PETROLEUM EAST OF CALIFORNIA
(Thousands of barrels of 42 U. S. gallons)

Domestic petroleum by fields of origin:	Mar., 1931 Total	Mar., 1931 Daily av.	Feb., 1931 Total	Feb., 1931 Daily av.	Jan.-Mar., 1931	Jan.-Mar., 1930
Appalachian:						
Pennsylvania Grade	1,737	56	1,670	60	5,232	5,962
Other (including Kentucky)	681	22	693	25	2,133	2,346
Lima, Northeast Indiana, Michigan	433	14	217	8	820	1,296
Illinois-Southwest Indiana	392	12	440	16	1,359	2,059
Mid-Continent:						
North Louisiana and Arkansas	3,056	99	3,123	111	9,697	9,451
West Texas, S. E. New Mexico	9,415	304	9,184	328	29,209	31,810
Other (Oklahoma, Kansas, North Texas, etc.)	33,427	1,078	27,739	991	89,502	94,363
Gulf Coast:						
Grade A	2,357	76	2,376	85	7,010	8,061
Grade B	3,676	119	3,061	107	9,998	9,850
Rocky Mountain	1,514	49	1,417	50	4,361	5,498
California	.....	.....	.....	.....	.....	70
Total demand	56,688	1,829	49,865	1,781	159,321	170,766
Exports	933	30	1,061	38	3,061	3,198
Domestic demand	55,755	1,799	48,804	1,743	156,260	167,568
Foreign petroleum	4,283	138	4,740	169	12,175	14,132
Total domestic demand east of California	60,038	1,937	53,544	1,912	168,435	181,700

(Continued on Next Page)

20,000
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ALCO has designed and is now constructing two 2-stage atmospheric and vacuum distilling units, each with a capacity of 10,000 barrels a day and embodying the most advanced principles of modern refinery practice.

These plants process a superior grade of crude oil for the manufacture of gasoline, naphtha, kerosene, gas oil, lubricating oils, and asphalt.

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ALCO PRODUCTS

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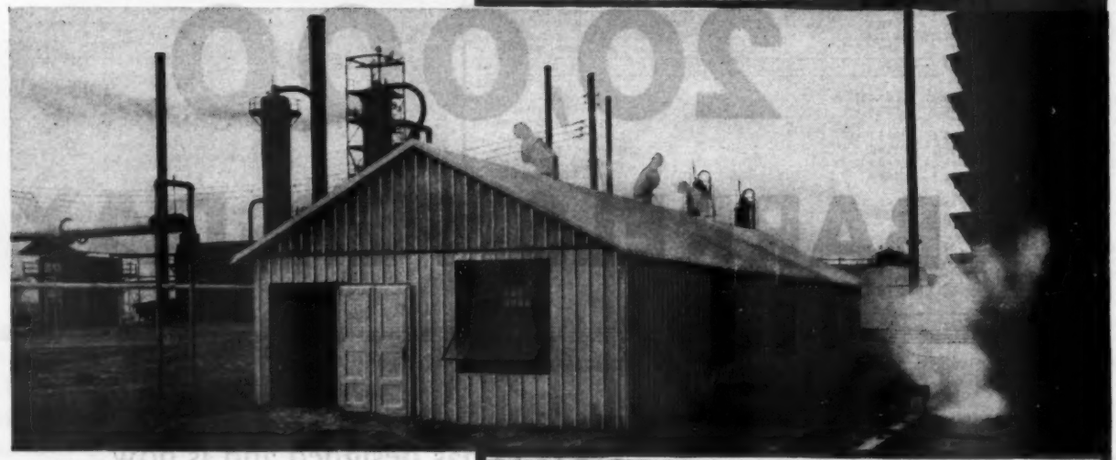
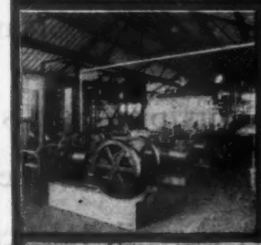


READY-MADE STEEL BUILDINGS Shelter Every Oil Field Activity



FIELD offices, dwellings, pump stations, power belt houses, flowing plants, refineries, material supply depots, warehouses, bunk and mess halls, garages . . . Butler Ready-Made Steel Buildings shelter practically every activity of the oil fields. And the reasons . . . fire-safeness to offset remoteness from fire protection, complete materials, ready made and readily transported to outpost operations, speed in erection by whatever sort of labor crew available, lower investment and maintenance charges, structural qualities which insure permanence, yet which permit enlarging or taking down and re-erection. Send for the new booklet picturing many Butler installations. Call upon Butler engineers to supply full details and prices on any type structure in mind.

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RUNS TO STILLS AND OUTPUT OF REFINERIES, MARCH, 1931
(Thousands of barrels of 42 U. S. gallons)

Input—	Crude oil: Domestic	Crude oil: Foreign	Crude oil: Total	Unfinished oils rerun	Natural gasoline	Total input
East Coast	10,278	4,136	14,414	748	130	15,292
Appalachian	3,130	...	3,130	182	43	3,355
Ind., Ill., Ky., etc.	9,237	....	9,237	118	219	9,574
Okla., Kans., Mo.	8,604	....	8,604	343	430	9,377
Texas	17,704	74	17,778	823	826	19,427
Louisiana and Arkansas	4,422	132	4,545	294	310	5,149
Rocky Mountain	1,496	....	1,496	303	96	1,895
California	14,392	....	14,392	255	*1,027	15,674
United States total	69,264	4,332	73,596	3,066	3,081	79,743
Texas Gulf Coast	12,877	74	12,951	805	591	14,347
Louisiana Gulf Coast	2,889	122	3,011	14	200	3,225

Output—	Gasoline	Kerosene	Gas oil and fuel oils: Gas oil and distillate fuels	Gas oil and fuel oils: Residual fuel oils	Gas oil and fuel oils: Total	Lubricants	Wax (thousands of lbs.)
East Coast	5,699	539	1,871	5,071	6,942	628	14,840
Appalachian	1,499	333	266	398	664	398	8,400
Ind., Ill., Ky., etc.	4,986	394	995	1,545	2,540	273	4,200
Okla., Kans., Mo.	4,962	609	1,029	1,779	2,808	237	2,520
Texas	5,366	1,010	2,091	5,465	7,556	496	3,080
Louisiana and Ark.	2,120	335	393	1,505	1,898	33	3,080
Rocky Mountain	951	76	75	274	349	48	1,400
California	6,105	380	2,010	5,987	7,997	180	....
U. S. total	34,688	3,676	8,730	22,024	30,754	2,293	37,520
Texas Gulf Coast	6,032	324	1,861	3,742	5,604	461	2,800
Louisiana Gulf Coast	1,466	286	284	907	1,191	13	3,080

Output (cont'd)—	Coke (tons)	Asphalt (tons)	Other finished products: Road oil	Other finished products: Miscellaneous	Other finished products: Total	Unfinished products	Shortage
East Coast	10,800	80,200	26	28	54	309	572
Appalachian	2,300	8,300	....	38	38	215	120
Ind., Ill., Ky., etc.	54,700	30,400	5	305	310	526	84
Okla., Kans., Mo.	37,600	2,000	6	130	136	101	363
Texas	51,600	12,400	12	23	35	651	971
Louisiana and Ark.	11,400	23,300	....	105	105	329	132
Rocky Mountain	11,600	200	14	26	40	322	44
California	400	33,400	51	166	217	153	456
U. S. total	170,400	190,200	114	821	935	2,606	2,742
Texas Gulf Coast	41,600	12,400	12	3	15	372	749
Louisiana Gulf Coast	11,200	14,900	....	71	71	33	15

*Includes 73,000 bbls. run through pipe lines.

GASOLINE PRODUCTION BY THE VARIOUS METHODS, MARCH, 1931
(Thousands of barrels of 42 U. S. gallons)

	Straightrun: Total	Straightrun: %	Cracked: Total	Cracked: %	Nat. gasoline: Total	Nat. gasoline: %	Grand total
East Coast	2,585	46	2,984	52	130	2	5,699
Appalachian	910	61	546	36	43	3	1,499
Ind., Ill., Ky., etc.	2,430	49	2,337	47	219	4	4,986
Okla., Kans., Mo.	2,766	56	1,766	35	430	9	4,962
Texas	4,183	50	3,357	40	826	10	8,366
Louisiana and Arkansas	763	36	1,047	49	310	15	2,120
Rocky Mountain	432	45	423	45	96	10	951
California	3,748	61	1,330	22	1,027	17	6,105
Total	17,817	51	13,790	40	3,081	9	34,688
Texas Gulf Coast	2,636	44	2,755	46	591	10	6,032
Louisiana Gulf Coast	496	34	770	52	200	14	1,466

SHIPMENTS OF MOTOR FUEL BY PIPE LINES
(Thousands of barrels of 42 U. S. gallons)

	Mar., 1931	Feb., 1931	Jan.-Mar., 1931
Motor fuel turned into lines	420	284	883
Motor fuel delivered from lines	256	224	642
Stocks in lines and working tanks end of month	441	*630	441

*Includes stocks set aside but not yet turned into the systems.

STOCKS HELD BY REFINING COMPANIES, MARCH 31, 1931*
(Thousands of barrels of 42 U. S. gallons)

	Gasoline	Kerosene	Gas oil and fuel oil: Gas oil and distillate fuels	Gas oil and fuel oil: Residual fuel oils	Gas oil and fuel oil: Total
East Coast	3,876	1,354	2,606	4,500	7,106
Appalachian	2,053	284	730	505	1,235
Ind., Ill., Ky., etc.	5,641	653	939	1,660	2,599
Okla., Kans., Mo.	4,225	645	2,032	2,917	4,949
Texas	7,310	923	2,771	6,145	8,916
Louisiana and Arkansas	2,131	456	588	1,657	2,245
Rocky Mountain	2,003	253	148	657	805
California	†15,534	1,832	4,250	(‡)	4,250
Total	47,773	6,300	14,064	18,041	32,105
Texas Gulf Coast	5,776	338	2,405	3,664	6,069
Louisiana Gulf Coast	1,948	436	428	936	1,364

	Lubricants	Wax (thousands of pounds): Crude scale	Wax (thousands of pounds): Refined	Wax (thousands of pounds): Total	Coke (tons)
East Coast	5,399	29,280	13,184	42,464	28,900
Appalachian	1,513	24,084	2,892	26,976	5,700
Ind., Ill., Ky., etc.	1,178	21,309	2,012	23,321	74,500
Okla., Kans., Mo.	719	1,092	1,628	2,720	83,800
Texas	2,625	1,185	12,593	13,778	600,300
Louisiana and Arkansas	209	71,788	1,398	73,186	67,200
Rocky Mountain	205	24,765	1,410	26,175	118,000
California	1,062	....	....	....	110,700
Total	10,710	173,503	35,117	208,620	1,089,100
Texas Gulf Coast	2,503	1,123	12,593	13,726	542,500
Louisiana Gulf Coast	188	71,788	1,398	73,186	67,000

	Asphalt (tons)	Other finished products: Road oil	Other finished products: Miscellaneous	Other finished products: Total	Unfinished oils: Natural gasoline	Unfinished oils: Other	Unfinished oils: Total
East Coast	135,500	50	62	112	227	9,295	9,522
Appalachian	20,800	...	79	79	11	1,477	1,488
Ind., Ill., Ky., etc.	75,900	...	295	295	41	5,215	5,256
Okla., Kans., Mo.	4,600	10	25	35	79	2,894	2,973
Texas	9,000	17	14	31	309	15,493	15,802
Louisiana and Ark.	54,900	...	12	12	21	2,479	2,500
Rocky Mountain	4,000	125	29	154	....	1,778	1,778
California	46,400	90	258	348	1,471	18,700	10,171
Total	354,100	292	774	1,066	2,159	47,331	49,490
Texas Gulf Coast	9,000	17	9	26	302	14,358	14,620
Louisiana Gulf Coast	36,200	...	5	5	9	1,805	1,824

*Stocks east of California represent inventories held by refining companies at or near refineries; California stocks represent inventories held by refining companies on the Pacific Coast of the United States at refineries, at or in transit to water terminals and bulk distributing stations. †Includes 329,000 bbls. engine distillate. ‡Included with heavy crude. §Includes 2,750,000 bbls. tops.

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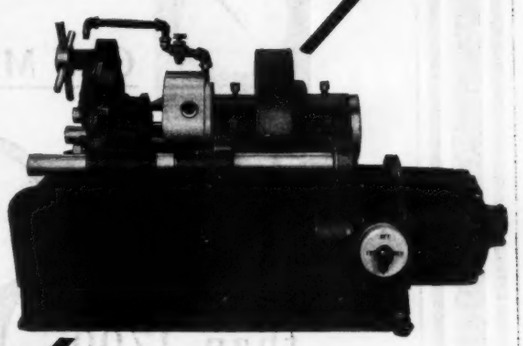
A NEW TOLEDO—



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To be eligible for this prize you must enter the "TOLEDO" Good-Tool Contest. There are forty-four other valuable prizes.

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Instrument Equipment...

For CONTROLLING Pipe Line Operating Conditions

Round Form Indicating Pressure Gauge arranged for flush mounting.

Round Form Recording Pressure Gauge arranged for flush mounting.

One Mid Western company uses more

Original Form Recording Pressure Gauge; uses 12 and 8-inch charts. Aluminum-alloy case; black finish.

Model 11-M Recording Pressure Gauge; black finish; aluminum-alloy case, of dust-, fume- and moisture-proof construction.

than 1700 Bristol's Recording Gauges

Round Form Recording Pressure Gauge; uses 10 and 8-inch charts. Case is of dust-, fume- and moisture-proof construction.

Industrial (Mercurial Type) Stem Thermometers. Features include: Solid, one-piece case construction, finest mercury column, and easy-to-read scale.

to check line pressures . . . another has in opera-

Industrial Stem Thermometer showing right-angle fitting. Fittings available to care for practically any requirement; for permanent installation or portable use.

Recording Thermometer shown complete with connecting tubing and sensitive bulb. Can be furnished with dust-, fume- and moisture-proof case.

tion 200 Recording Thermometers to check

Indicating Pyrometer, Model 420. Used up to 3000° F. Has extra wide scale . . . very easy to read.

New Multiple Rotary Selective Switch used with Bristol's Pyrometer equipment. Standard Switch has 12 contact points. Can also be arranged for 4, 6, 8 and 10.

gas temperatures in lines supplying industrial consumers.

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SHIPMENTS FROM CALIFORNIA TO EASTERN PORTS IN UNITED STATES*
(Thousands of barrels of 42 U. S. gallons)

Crude oil:	March, 1931	February 1931	Jan.-Mar., 1931	Jan.-Mar., 1930
Refined products	1,892	1,577	5,141	5,660
Gasoline	1,643	1,116	3,948	4,327
Natural gasoline	....	260	396	....
Kerosene	42	....	88	99
Gas oil†	192	198	677	1,014
Diesel oil	....	....	....	144
Fuel oil	....	1	2	10
Lubricants	13	1	26	59
Asphalt	2	1	4	7

*Compiled by E. T. Knudsen of the San Francisco office of the Bureau of Mines.
†Revised figure for January, 1931—287,000 bbls.

NUMBER OF WELLS COMPLETED IN THE UNITED STATES*

	March, 1931	February, 1931	Jan.-Mar., 1931	Jan.-Mar., 1930
Oil	333	456	1,320	3,119
Gas	182	218	602	573
Dry	381	397	1,219	1,520
Total	946	1,065	3,141	5,212

*From The Oil and Gas Journal and California office of the American Petroleum Institute.

RECORD OF WELLS FOR IMPORTANT FLUSH FIELDS, MARCH, 1931*

	Completions: Oil	Gas	Dry	Total initial prod. (bbls.)	Aver. initial prod. (bbls.)	Drilling Mar. 31
Texas	189	22	193	289,200	1,500	818
Darst Creek	2	...	...	1,600	800	7
Rusk-Gregg	57	...	9	218,200	3,800	135
West Texas	17	1	13	3,900	200	120
California	18	...	33	6,400	400	276
Long Beach	4	...	8	800	200	28
Playa Del Rey	8	...	...	4,400	600	19
Santa Fe Springs	...	...	...	.....	.....	1
Oklahoma	53	13	36	174,900	3,300	341
Oklahoma County	24	...	...	144,100	6,000	84
Pottawatomie and Seminole Counties	11	...	6	26,100	2,400	27
New Mexico	2	...	1	4,100	2,100	49
Lea County (Hobbs)	2	...	...	4,100	2,100	7
Other states	121	147	118	16,800	100	1,118
Total United States	383	182	381	491,400	1,300	2,602

*From The Oil and Gas Journal and California office of the American Petroleum Institute.

IMPORTS AND EXPORTS OF CRUDE PETROLEUM AND MAJOR REFINED PRODUCTS*
(Thousands of barrels of 42 U. S. gallons)

	March, 1931 Total	March, 1931 Daily av.	February, 1931 Total	February, 1931 Daily av.	Jan.-Mar., 1931	Jan.-Mar., 1930
CRUDE PETROLEUM:						
Imports:	3,715	120	4,789	171	12,857	14,598
From Mexico	240	8	522	19	1,007	1,342
From Venezuela	1,850	60	2,386	85	6,836	9,209
From Colombia	1,367	44	1,711	61	4,358	3,498
From other countries	258	8	170	6	656	549
Exports:						
Domestic crude oil:	1,586	51	1,710	61	5,215	5,483
To Canada	1,180	38	1,389	50	3,924	4,106
To other countries	406	13	321	11	1,291	1,377
Shipments	....	....	....	....	....	....
Foreign crude oil	....	....	....	....	....	....
REFINED PRODUCTS:						
Gasoline:						
Imports	1,607	52	948	34	3,671	3,401
Exports†	2,946	95	3,606	129	11,455	16,703
To United Kingdom	751	24	1,243	45	3,778	4,927
To France	320	10	515	18	1,612	2,716
To Canada	146	5	182	7	504	552
To other countries	1,627	53	1,663	59	5,286	8,105
Shipments	102	3	3	....	275	403
Kerosene:						
Exports:	1,163	38	977	35	3,433	4,918
To China	92	3	116	4	410	541
To United Kingdom	314	10	312	11	959	746
To other countries	745	24	546	20	2,031	3,579
Shipments	12	1	3	....	33	52
Gas oil and fuel oil:						
Imports	2,449	79	1,956	70	6,876	7,163
Exports:	2,260	73	2,555	91	7,795	9,743
To Chile	248	8	311	11	964	1,192
To Panama	153	5	254	9	823	704
To other countries	1,576	51	1,639	59	5,129	6,704
Shipments	283	9	351	12	879	1,143
Lubricants:						
Exports:	547	18	557	20	1,791	2,507
To United Kingdom	120	4	124	5	316	583
To France	109	4	53	2	374	346
To other countries	302	10	374	13	1,084	1,554
Shipments	6	....	6	....	17	24
Wax (thousands of lbs.):						
Imports	1,289	42	3,035	108	6,969	6,451
Exports	30,470	983	23,503	839	76,036	71,163
To United Kingdom	4,481	145	5,048	180	15,327	14,422
To Italy	10,025	323	4,833	173	17,485	12,626
To other countries	15,961	515	13,621	486	43,217	44,111
Shipments	3	....	1	....	7	4

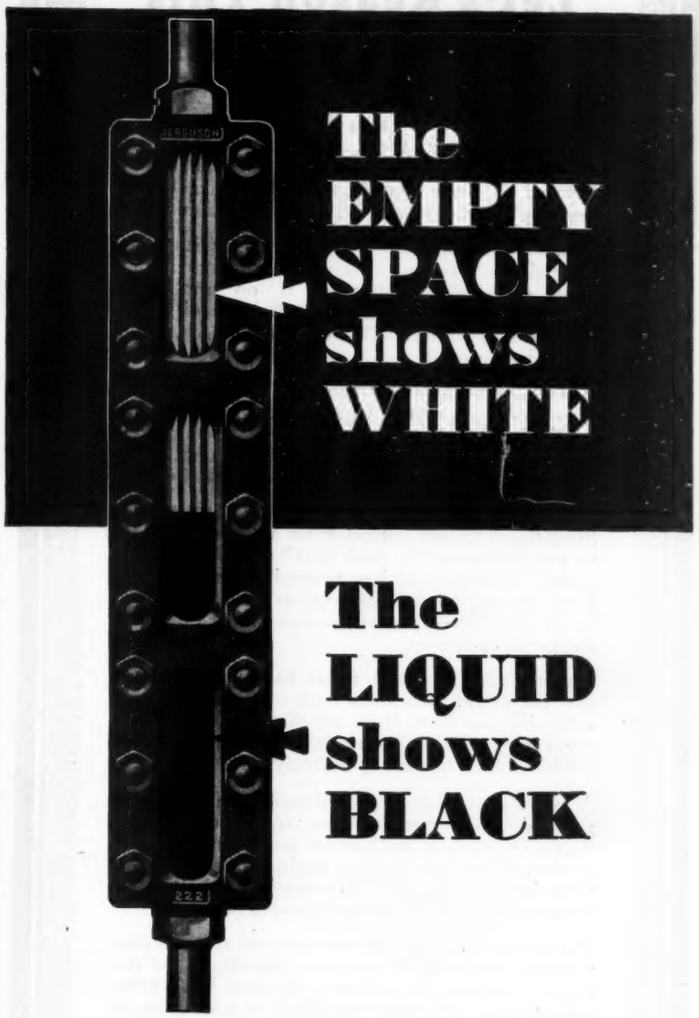
*From Bureau of Foreign and Domestic Commerce. †Includes benzol—3,000 bbls. in March.

PRODUCTION OF CRUDE PETROLEUM BY FIELDS
(Thousands of barrels of 42 U. S. gallons)

FIELD:	Mar., 1931 Total	Mar., 1931 Daily av.	Feb., 1931 Total	Feb., 1931 Daily av.	Jan.-Mar., 1931	Jan.-Mar., 1930
Appalachian:						
Pennsylvania Grade	1,751	57	1,641	59	5,171	6,610
Other (including Kentucky)	807	26	708	25	2,262	2,467
Lima, Northeast Indiana, Michigan	386	13	338	12	1,094	1,440
Illinois-Southwest Indiana	430	14	442	16	1,350	1,721
Mid-Continent:						
North Louisiana and Arkansas	2,641	85	2,560	91	7,984	8,591
West Texas-S. E. New Mexico	8,458	273	7,999	286	25,481	31,290
Other (Oklahoma, Kansas, North Texas, etc.)	31,603	1,019	25,343	905	83,982	93,934
Gulf Coast:						
Grade A	1,670	54	1,607	58	5,486	8,229
Grade B	3,538	114	3,426	122	10,283	9,004
Rocky Mountain	1,748	56	1,650	59	5,158	5,799
California	16,365	528	14,931	533	47,782	62,569
Total	69,397	2,239	60,645	2,166	196,033	231,564
CLASSIFICATION BY GRAVITY (approx.):						
Light crude	62,616	2,020	54,306	1,940	175,484	203,942
Heavy crude	6,781	219	6,339	226	20,549	27,622

(Continued on Next Page)

This gage shows in *BLACK* and *WHITE*



The EMPTY SPACE shows WHITE

The LIQUID shows BLACK

JERGUSON REFLEX GAGE

Shows oil level with the full visibility of black on white. Leading oil companies are using it on tanks, towers, stills, etc.

For 25 years these gages have demonstrated safety under highest pressures and temperatures. We furnish them with or without valves for every type of service. Write us for information.

JERGUSON GAGE & VALVE CO.
MYSTIC AVE. AND NORTHERN ARTERY
SOMERVILLE, MASS.

Billions of Bubbles

Let's Reason This Thing Out Together

WHAT would a perfect absorption plate look like? Well, let's see. Since plate efficiency demands intimacy of contact between gas and oil, there would have to be a large number of ports to insure perfect distribution.

If the ports are too large, the oil will drop through and the gas will pass through without being thoroughly contacted; if too small, the pressure drop will be so great that capacity will be seriously limited. The size of the port, then, is predetermined.

But an open port (in the form of a perforation), no matter what its size, starts the gas off in a vertical direction, the shortest way through the oil. The path desired is a circuitous one. This calls for deflectors that will start the gas flowing in horizontal paths.

Shall there be one deflector for a group of ports, or one deflector for each port? The first mentioned arrangement has proved unsatisfactory, for it causes patches of dead area. There must be no dead area, therefore there must be a deflector at each port.

Furthermore, if these ports can be so placed that the gas stream from each of them conflicts with the gas flow from all surrounding ports, the result will be myriads of extremely fine bubbles, with a correspondingly vast film area.

A plate designed in accordance with the foregoing derived specifications would seem to be about as perfect as human engineering could evolve. Modesty forbids saying more, for the plate here projected is the new Campbell High Efficiency plate, as actually constructed.

No matter what sort of column you are contemplating—absorber, evaporator, stabilizer, or refinery fractionating column—the new High Efficiency plate will help you arrive at a solution to your problem. It is simple and rugged and, like the "Oil-Froth" plate, is built for packing into shells with belted heads.

In view of the outstanding superiority of the Campbell High Efficiency plate, can you afford not to know all about it? Complete information furnished upon request.

J. A. CAMPBELL CO.
Natural Gas Engineers
CONSULTING DESIGNING CONSTRUCTING
PHONE-41693
P.O. DRAWER 669
LONG BEACH, CAL.

STEARNS-ROGER MFG. CO., DENVER
MID-CONTINENT AGENCY

Originators of Oil-Froth Absorbers

CRUDE PETROLEUM PRODUCTION BY STATES WITH CLASSIFICATION BY GRAVITY
(Thousands of barrels of 42 U. S. gallons)

	Mar., 1931 Total	Mar., 1931 Daily av.	Feb., 1931 Total	Feb., 1931 Daily av.	Jan.-Mar., 1931	Jan.-Mar., 1930
Arkansas	1,432	46	1,371	49	4,342	5,057
California:						
Long Beach	2,789	90	2,658	95	8,324	9,567
Santa Fe Springs	2,204	71	1,995	71	6,422	14,970
Rest of State	11,372	367	10,278	367	33,036	38,032
Total California	16,365	528	14,931	533	47,782	62,569
Colorado	135	4	126	5	400	435
Illinois	372	12	376	13	1,157	1,490
Indiana:						
Southwestern	58	2	66	3	193	231
Northeastern	4	....	4	....	12	11
Total Indiana	62	2	70	3	205	242
Kansas	3,292	106	3,031	108	9,425	9,705
Kentucky	611	20	524	19	1,681	1,880
Louisiana:						
Gulf Coast	783	25	830	30	2,455	1,764
Rest of State	1,209	39	1,189	42	3,642	3,534
Total Louisiana	1,992	64	2,019	72	6,097	5,298
Michigan	291	10	243	9	795	1,103
Montana	255	8	237	8	748	666
New Mexico	1,181	38	1,087	39	3,453	961
New York	265	8	274	10	824	1,015
Ohio:						
Central and eastern	389	13	356	13	1,136	1,313
Northwestern	91	3	91	3	287	326
Total Ohio	480	16	447	16	1,423	1,639
Oklahoma:						
Oklahoma City	4,489	145	2,618	94	9,695	6,948
Seminole	4,862	157	4,071	145	13,935	24,265
Rest of State	7,935	256	7,413	265	22,926	25,544
Total Oklahoma	17,286	558	14,102	504	46,556	56,757
Pennsylvania	916	30	847	30	2,683	3,506
Tennessee	1	....	2	....	3	3
Texas:						
Gulf Coast	4,425	143	4,203	150	13,314	15,469
East Texas	2,887	93	667	24	3,655	.....
West Texas	7,310	236	6,960	249	22,157	30,466
Rest of State	8,138	262	7,543	269	24,346	27,472
Total Texas	22,760	734	19,373	692	63,472	73,407
West Virginia	376	12	346	12	1,101	1,360
Wyoming:						
Salt Creek	801	26	734	26	2,338	2,668
Rest of State	524	17	505	18	1,543	1,803
Total Wyoming	1,325	43	1,239	44	3,881	4,471
Total United States	69,397	2,239	60,645	2,166	196,033	231,564

STOCKS OF CRUDE PETROLEUM
(Thousands of barrels of 42 U. S. gallons)

	Mar. 31, 1931	Feb. 28, 1931	Mar. 31, 1930
EAST OF CALIFORNIA:			
At refineries by location:			
East Coast: Domestic	9,321	10,201	8,876
Foreign*	3,437	3,966	5,064
Appalachian	2,481	2,549	3,001
Indiana, Illinois, Kentucky, Michigan, etc.	2,581	2,495	3,333
Oklahoma, Kansas and Missouri	5,146	5,087	5,281
Texas: Inland	1,367	1,742	2,105
Gulf Coast: Domestic	7,502	6,900	9,992
Foreign*	345	366	271
Arkansas and Inland Louisiana	429	449	994
Louisiana Gulf Coast: Domestic	5,591	5,678	4,146
Foreign	753	771	1,216
Rocky Mountain	1,843	1,822	1,646
Total	40,786	42,027	45,925
At refineries by origin:			
Pennsylvania grade	2,214	2,297	2,842
Other Appalachian (inc. Kentucky)	732	726	939
Lima-N. E. Indiana-Michigan	162	165	161
Illinois-S. W. Indiana	94	103	155
North Louisiana and Arkansas	3,605	3,591	4,711
West Texas and S. E. New Mexico	4,792	4,866	4,569
Oklahoma, Kansas, North Texas, etc.	16,224	16,012	16,899
Gulf Coast: Grade A	3,001	3,438	4,592
Grade B	3,534	3,904	2,821
Rocky Mountain	1,838	1,817	1,644
California	5	5	41
Foreign*	4,535	5,103	6,551
Total	40,786	42,027	45,926
Pipe-line and tank-farm:			
Pennsylvania grade	5,681	5,584	4,974
Other Appalachian (inc. Kentucky)	1,043	873	975
Lima-N. E. Indiana-Michigan	1,579	1,620	791
Illinois-S. W. Indiana	10,249	10,194	10,196
North Louisiana and Arkansas	19,128	19,562	21,199
West Texas and S. E. New Mexico	42,175	42,926	52,919
Oklahoma, Kansas, North Texas, etc.	187,238	189,321	198,761
Gulf Coast: Grade A	5,861	6,106	8,754
Grade B	11,653	11,414	10,915
Rocky Mountain	25,770	25,600	24,598
Total	310,377	313,310	334,082
Total refinery, pipe-line, and tank-farm	351,163	355,337	380,007
Producers'	6,500	6,550	6,150
Total crude east of California	357,663	361,887	386,157
CALIFORNIA: Light	41,016	40,651	44,710
Heavy (including fuel)	100,531	101,442	107,414
Total crude (including fuel oil in California)	499,210	503,980	538,281

*Includes importers' stocks.

PRODUCTION OF MOTOR FUEL
(Thousands of barrels of 42 U. S. gallons)

	March, 1931 Total	March, 1931 Daily av.	February, 1931 Total	February, 1931 Daily av.	Jan.-Mar., 1931	Jan.-Mar., 1930
Straightrun gasoline	17,817	575	15,465	553	48,920	57,423
Cracked gasoline	13,790	445	12,262	438	39,337	38,454
Natural gasoline:						
Blended at refineries	3,008	97	3,018	108	9,195	10,302
Blended at plants*	14	1	13	1	40	76
Run through pipe lines†	73	2	73	2	215	632
Jobbers, exports, etc.	350	11	325	11	1,025	700
Benzol produced‡	194	6	172	6	550	731
Total Motor Fuel	35,246	1,137	31,328	1,119	99,282	108,330

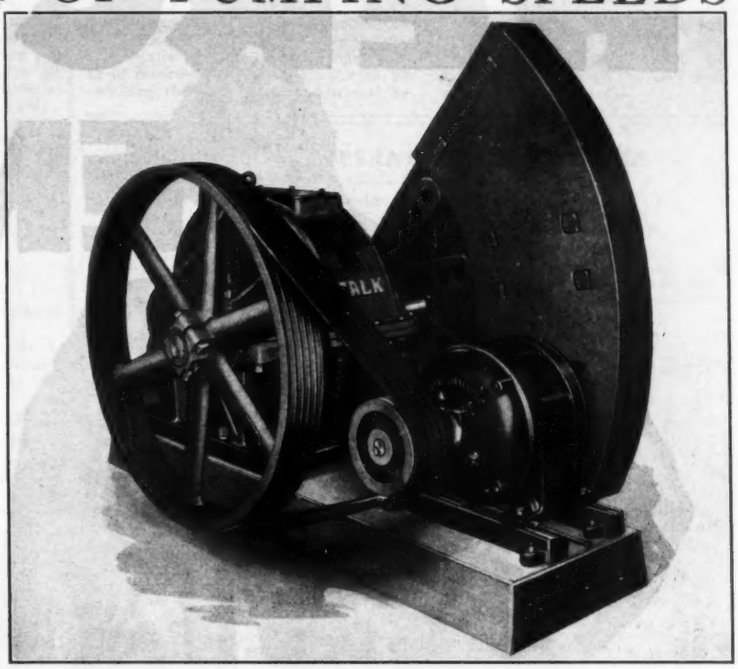
*East of California. †To refineries in California. ‡Estimated.

PRODUCTION AND DISTRIBUTION OF NATURAL GASOLINE
(Thousands of barrels of 42 U. S. gallons)

	March, 1931 Total	March, 1931 Daily av.	February, 1931 Total	February, 1931 Daily av.	Jan.-Mar., 1931	Jan.-Mar., 1930
Production	4,048	131	3,631	130	11,819	131
Decrease in all stocks	....	....	42	1	....	....
Total	4,048	131	3,673	131	11,819	131
Blended at refineries	3,008	97	3,018	108	9,195	102
Run through pipe lines in Calif.	73	2	73	2	215	2
Blended at plants east of Calif.	14	1	13	1	40	1
Jobbers, exports, etc.	350	11	325	11	1,025	11
Increase in all stocks	377	12	....	....	665	7
Balance	226	8	244	9	679	8
Total	4,048	131	3,673	131	11,819	131

TEXROPE DRIVE FOR FIRST REDUCTION GIVES WIDE RANGE OF PUMPING SPEEDS

Allis-Chalmers Oil Well Pumping Units



The Allis-Chalmers Double Reduction Unit for Oil Fields uses a Texrope Drive as the first reduction and a Falk Speed Reducer as the second. The size of the Texrope Sheave may be changed to give a variety of desired speed ratios.

Specially Designed Falk Speed Reducer is Second Reduction

In the Allis-Chalmers Double Reduction Oil Well Pumping Units, the first reduction is a Texrope Drive. By changing the small sheave on the motor a wide variety of pumping speeds can be obtained. The flexible Texrope Belts absorb shock and assure uninterrupted service. The Falk Reducer is an over-size unit for heavy duty, giving 20 r.p.m. on the slow speed shaft.

On the No. 11 Oil Well Unit the slow speed shaft permits mounting a sprocket to drive the hoist. The No. 9 Unit is used where the load does not exceed 20 H.P. and is for pumping only. Ask for a copy of Bulletin 1244.

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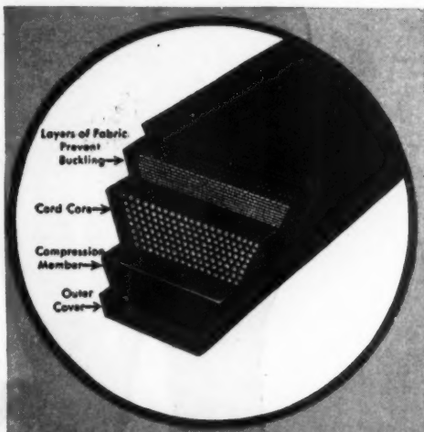
ALLIS-CHALMERS MANUFACTURING CO., (Texrope Division)
MILWAUKEE *Specialists in Power Machinery Since 1846* WISCONSIN



— another B.F.Goodrich Product

In the development of Texrope Drives the B. F. Goodrich Rubber Co. has contributed belts that possess amazing ability to stand up under constant flexing. Well over 600,000 Texrope Belts are now in use . . . and some of those put in service five years ago are still in operation. The newest design, here illustrated, promises to give even longer service. When new belts are finally needed, be sure to install genuine Texropes . . . product of B. F. Goodrich.

ORIGINATED BY ALLIS-CHALMERS
TEXROPE DRIVES
THE DRIVES THAT REVOLUTIONIZED TRANSMISSION PRACTICE • • •

HERCULES ENGINES

HERCULES Engines—Fours and Sixes ranging in size from 15 to 175 H. P.—are built solely for heavy-duty service. They power water pumps and slush pumps, cable and rotary drilling rigs, spudders and winches, compressors, generators, arc welders and other types of oil-field equipment. In the realm of heavy-duty power Hercules Engines and Power Units have earned a position of acknowledged leadership.

HERCULES MOTORS CORPORATION
CANTON, OHIO, U. S. A.

New York Office: Chanin Building, New York, New York
Mid-Continent Office: Mayo Building, Tulsa, Oklahoma
West Coast Office: Russ Building, San Francisco, California

FRANK KIRK DISLIKED PERMANENT ADDRESSES

(Continued from Page 68)

him off, declaring the company had failed to fulfill its obligations.

Not a Leg to Stand On

Frank returned to the office and reported to Mr. McBride, who in turn consulted the company's attorney. The lawyer declared the company had kept its every obligation to the letter and that the protesting farmer did not have a leg to stand on.

Frank went back to the lease. This time the farmer had a shotgun. He did no threatening, but at short intervals he would fire a load of shot along the line fence which it was necessary to cross to reach the well. Neither Frank nor the teamsters who had come to haul away the casing cared to cross the line in view of this significantly hostile demonstration. Each had a deep conviction that if he tried it he would be peppered with shot. Frank went to a telephone and reported the situation to Mr. McBride.

The president of the company conferred briefly with the lawyer and then telephoned back to Frank, "Our lawyer says we have a perfect right to cross that line."

"All right," responded Frank, "you tell him to come out and cross it. And he hung up the receiver. The company later succeeded in mollifying the farmer.

Mr. Kirk is an Elk, a Rotarian and a member of the Natural Gas Department of the A.G.A. He is active in the Houston Chamber of Commerce and the Mid-Continent Oil and Gas Association. He and Mrs. Kirk reside in Houston. A daughter, Mrs. John Baginski, resides in Los Angeles, Calif., and a son, Timothy Kirk, is a high school student in Houston.

INDUSTRY DEVELOPMENT CHANGES ITS CHARACTER

(Continued from Page 61)

potentially enormous volume of 1,000 B.t.u. gas must have been far reaching. So it has proved; and today there is probably no part of the gas industry which is not affected directly or indirectly by its advent. For example, the change over from previously distributed manufactured gas to natural gas, as a substitute, or as an auxiliary supply for mixing with a manufactured gas, has presented innumerable problems to our technical section. An example of this is seen in the study of all joints, and particularly the older types, with a view to repairing them for modern conditions of higher pressure as well as the introduction of drier gas.

Butane and Propane

The distribution and chemical committee are endeavoring to determine the effect of increased quantities of natural gas on distribution systems from the standpoint of leak detection and odorization together with all data that can be compiled on oil fogging, rehydration and the effect of a drier gas on meters and meter diaphragms.

There has been another very interesting development in the United States which we have watched grow, almost over night, from a business supplying a relatively small and rather circumscribed demand to one of potentially large magnitude. Its applications are manifold and in many instances only restricted by transportation costs. I refer to higher members of the series of organic chemical compounds known as saturated hydrocarbons such as propane and butane, which are easily liquefied and just as easily gasified. By separating them from the natural gasoline extracted from natural gas, new fuels have become available.

Propane, which boils at the lower temperature, is so readily gasified, and requires so little heat for vaporizing it, that it is an ideal fuel for domestic gas installations beyond the reach of gas mains; it is distributed in steel bottles containing from 60 pounds to 100 pounds of liquid (21,600 B.t.u. per pound). By the use of a suitable pressure regulating valve, it can be burned in ordinary gas burners, bringing gas service to thousands of homes where otherwise gas would be out of the question.

Butane boils at a somewhat higher temperature than propane, and is similar to it, but is not so well suited for domestic installations; it has brought gas to small communities ranging from a few hundred to 5,000 population by means of butane-air-dilution plants. Seventeen per cent of butane vapor is mixed with 83 per cent of air and this mixture, because of the low partial pressure of the butane in it, will behave as a permanent gas.

The development of the liquefied petroleum gases is so new that no predictions can be made now as to the position they may eventually occupy in the gas industry.

EASTERN FIELDS

(Continued from Page 56)

has been rigged up but operations have been suspended.

T. L. Shop and others' test on the I. T. Gorrell farm in Lafayette district, Pleasants County, is shut down at 250 feet.

SOUTHWEST PENNSYLVANIA

The Southwest Pennsylvania Field's only completion is in Greene County. It is the property of the Philadelphia Gas Co. and is on the Spencer Stephens farm in Perry Township. This well, which was drilled deeper, is a very light gasser in the Big Injun sand.

In Greene County, D. L. Shafer & Co. are shut down in their test on the William Jones farm in Wayne Township, after drilling it down to a depth of 850 feet. The Manufacturers Light & Heat Co.'s No. 3,443, on the Felix Bell farm, in the same township, is drilling at 1,175 feet, and in Center Township, J. B. Orndoff's test on the J. E. Scott farm, has reached 1,770 feet in the process of drilling, while the test of the Carnegie Natural Gas Co. on the F. G. Jacobs farm, in Center Township, is drilling at the 1,300-foot level.

The Natural Gas Co. of West Virginia has sunk its drilling tools to a depth of 3,310 feet in No. 703 on the S. A. Post farm in South Franklin Township, Washington County. In Chartiers Township, and on the A. Woodruff farm, Potts Brothers have constructed a rig. M. Green & Co.'s test, on the John Craig farm in Donegal Township, has been drilled down to a depth of 1,600 feet.

In Butler County, the T. W. Phillips Gas & Oil Co. has its test on the Johnson Elsenrath farm in Buffalo Township at the 350-foot level.

SCIENTIFIC SEARCH FOR HELIUM GAS

(Continued from Page 61)

presence of radioactive materials in substantial quantity.

The opening of a new helium field would be of tremendous importance to the lighter-than-air craft industry due to its scarcity and high production cost. The present source of supply, maintained by the United States Government, is located in the Amarillo district of Texas and produces 24,000,000 feet per year at an approximate cost of $34 per 1,000 feet. This, though sufficient for present dirigible needs, will not begin to meet the demand for helium gas in the next few years. The Navy's dirigible, "Los Angeles," has a gas capacity of 2,500,000 feet, when inflated to 95 per cent of its displacement with 98 per cent pure helium gas. The purity of the gas will drop to 94 per cent the first month and will continue depreciating at the rate of 60,235 feet, or 2½ per cent per month. On this basis the loss for 11 months, including repurifications of the entire contents of each gas cell, would be 977,265 feet. However, under normal government use and including valvage and leakage, the total annual loss in helium gas in a ship of the Los Angeles type, has been found to be as high as 144 per cent.

The new Akron, which is being built at the Goodyear plant in Ohio, will require 6,500,000 feet of gas and its yearly replacement will be about the same percentage as quoted above. Four other ships of 7,000,000-foot capacity are projected by a German-American syndicate of American registry for transatlantic passenger service. These ships will have a total capacity of 28,000,000 feet in excess of the present production of helium gas and the annual replacement will require an additional 40,000,000 feet. It is reported that other syndicates are awaiting the discovery of additional helium gas deposits and will start the construction of dirigibles for transcontinental passenger and freight service as soon as an adequate supply is available at economic prices. Doctor Mercer states that the present search for helium gas being conducted in the San Fernando Valley is in accordance with theories which he has established, and if it is successful, he will submit his survey to the Government at Washington to be used in further searches for this gas.

WILDCAT OPERATIONS IN OKLAHOMA

(Continued from Page 29)

GREER COUNTY

French's No. 1 Murphy, SW NW Sec. 23-7-21w ..... Shut down 1,645 ft.

HARPER COUNTY

Sinclair Oil & Gas Co.'s No. 1 Howell, C SW SW Sec. 14-26-24w ..... 20,000,000 ft. gas 5,350-5,400 ft.; total depth 8,539 ft.; shut down; sprayed 50 bbls. gasoline.

HASKELL COUNTY

Ault et al's No. 1 Harrison, CWL SE NE Sec. 14-9-19 .... Shut down 650 ft.
Ault et al's No. 1 Hall, NW SW SW Sec. 14-9-19 ..... Shut down 2,000 ft.
Ault et al's No. 1 Hall, SE NW Sec. 25-9-19 ..... Shut down 200 ft.
Finefield's No. 1 Ogle, NW cor. Sec. 6-7-20 ..... Completed 792-875 ft.; 1,000,000 ft. gas.
Holden's No. 1 Phillip, SE cor. Sec. 3-9-18e ..... Shut down 1,860 ft.
Marion Oil's No. 1 Sanders, NW NE NW Sec. 10-9-18e .. Shut down 2,387 ft.

HUGHES COUNTY

Wright et al's No. 1 Ott, SE SW Sec. 15-5-11 ..... Shut down 1,645 ft.

KAY COUNTY

Wilwright Gas Co.'s No. 1 Wildegrube, NE SW Sec. 14-27-1 ..... Shut down 4,055 ft.; csg. collapsed, will abandon.
Lewis et al's No. 1 Harris, SE NW Sec. 14-25-1 ..... Location.
Peters & Buckles' No. 1 Hayes, NW NE NW Sec. 24-28-3 ..... Wilcox 3,662-65 ft.; water; shut down.
Mummert Drlg. Co. et al's No. 1 Cormick, C NW SE Sec. 9-27-2 ..... Cleaning out 3,693 ft.
Blackwell Oil Co.'s No. 1 Harshman, Sec. 2-26-1w ..... Rig on ground.
Boucher Oil Co.'s No. 1 Jefferson, NE SW Sec. 32-26-1w.. Abandoned 4,634 ft.

KIOWA COUNTY

Christian's No. 1 Jones, NE SE Sec. 8-7-18w ..... Shut down 220 ft.

LATIMER COUNTY

Choctaw Gas' No. 1 Weaver, C NE NW Sec. 4-6-18 ..... Abandoned 3,475 ft.
P. English's No. 1 Unknown, NW SE Sec. 16-6-19 ..... Shut down 1,542 ft.

LE FLORE COUNTY

Sooner Oil & Gas' No. 1 Clyman, C S half NE NW Sec. 28-7-26 ..... Drlg. 630 ft.
Sooner Oil & Gas Co.'s No. 1 Peck, SE SW SE Sec. 22-7-26 ..... Drlg. 1,698-1,920 ft.; show gas; T. D. 1,930 ft.; abnd.

McINTOSH COUNTY

Patterson et al's No. 1 Smith, SW cor. NW SE Sec. 32-9-16 ..... Drlg. 5,705 ft.

MURRAY COUNTY

C. R. Williams et al's No. 1 Williams, C NE NE Sec. 21-1-4 ..... Drlg. 730 ft.

MUSKOGEE COUNTY

H. E. Dowd's No. 1 Hembree, C NW NE Sec. 23-10-19 .. Drlg. 750 ft.
Rebold's No. 1 Miller, SE NE NE Sec. 32-13-19 ..... Rig.
Sioux Oil Co.'s No. 1 Unknown, NW SE Sec. 21-11-19 .... Shut down 1,011 ft.

OKFUSKEE COUNTY

E. L. Robinson's No. 1 Rice, NW Sec. 2-10-9 ..... Location.
Shepard et al's No. 1 Neveas, SE NW SW Sec. 3-12-10.. Shut down 3,690 ft.

OKLAHOMA COUNTY

Citizens Oil Co.'s No. 1 Sage Barber, NE cor. Sec. 21-11-3w ..... Shut down 1,200 ft.
L. C. Hivick's No. 1 Sunset Addition, NW SW NW Sec. 17-11-3w ..... Shut down 5,515 ft.
J. F. Cuniff, trustee's No. 1 Church Land, NE NW SE Sec. 17-12-4w ..... Shut down 6,700 ft.

PAWNEE COUNTY

Comar's No. 1 Babstick, SW SE SE Sec. 18-22-5 ..... Drlg. 3,261 ft.
Rookstool's No. 1 Wylie, NW NE SW Sec. 6-20-5 ..... Shut down 1,950 ft.
Sperry et al's No. 1 Mullrap, SE SW Sec. 2-22-5 ..... Drlg. 2,770 ft.
Cochran et al's No. 1 Green, NE cor. SW Sec. 15-23-5 .... Rig.

PITTSBURG COUNTY

J. Morrison's No. 1 Fowler, NE SE Sec. 13-7-17 ..... Rig.
C. Kennedy's No. 1 Travis, C SW NE Sec. 15-7-14 ..... Rig.
C. Canady's No. 1 Jones, NW cor. Sec. 14-8-14 ..... Rig.

POTTAWATOMIE COUNTY

Droppleman et al's No. 1 Jones, SE NW Sec. 21-8-3 .... Rigging up standard tools 4,775 ft.

ROGER MILLS COUNTY

Ute Oil Co.'s No. 1 Williams, C SW Sec. 23-12-24w ..... Shut down 4,830 ft.
L. C. Hivick's No. 1 Davis, C NW NE Sec. 4-11-26w .... Fishing 2,956 ft.

SEMINOLE COUNTY

Sunray Oil Co.'s No. 1 Sunray, NW SE Sec. 35-5-5 ..... Location.

STEPHENS COUNTY

Ross Southerd's No. 1 McKinney, NE cor. Sec. 25-1-8w .. Shut down 1,062 ft.

WASHITA COUNTY

Cooper & Terhune's No. 1 Blocker, NW cor. Sec. 29-8-19w. Drlg. 1,875 ft.
Burns & Prince's No. 1 Deck, SW cor. Sec. 21-8-18 ..... Shut down 1,050 ft.
Petroleum Holdings, Inc.'s No. 1 Music, NW cor. Sec. 10-9-20w ..... Shut down 280 ft.

OKLAHOMA PANHANDLE

TEXAS COUNTY

Western Prod. Co.'s No. 1 Gable, C NE Sec. 24-4-13 ..... Rig.
Three Way Oil Co.'s No. 1 Crane, SW NW Sec. 11-1-18 .. Shut down 4,625 ft.

SOUTHERN OKLAHOMA

ATOKA COUNTY

R. P. Whelan et al's No. 1 Howard, NW SE NW Sec. 6-4s-11 ..... Drlg. 580 ft.
Brookshire's No. 1 R. W. Rowland, NW NE SE Sec. 18-3s-10 ..... Shut down 400 ft.

BRYAN COUNTY

Bryan County Oil's No. 1 Childs, NW SE SW Sec. 7-7-10.. T. D. 650 ft.
Bush et al's No. 1 Commerce Trust, NE cor. Sec. 35-6s-9 ..... T. D. 740 ft.; plugged back to 450-80 ft.

JEFFERSON COUNTY

Smith's No. 1 McCarty, SE NW NE Sec. 18-4s-8w ..... Location.
C. V. Chenault et al's No. 1 Grogan, SW NE SE Sec. 15-7s-6w ..... Drlg. 1,327 ft.

LOVE COUNTY

Batson & Sterrette's No. 1 Dillard, SE NE NW Sec. 25-6s-3 ..... Show 5 bbls. 1,585-96 ft.; T. D. 4,433 ft.; P. B. to 1,604 ft.; pumping.
Holmes et al's No. 1 Flannigan, NW cor. Sec. 2-8s-1 .... Rig.

McCURTAIN COUNTY

The Oil Journal's No. 1 Parks, C NE NW Sec. 9-6s-23 ... Shut down 50 ft.
Stewart's No. 1 Patterson, C SE SE Sec. 7-6s-24 ..... Drlg. 400 ft.

MARSHALL COUNTY

McCrory et al's No. 1 Little, NW SW Sec. 30-7s-6 ..... Bailing 10 bbls. of oil 495-97 ft.; recemented csg.
D. H. Curry's No. 1 Ward, NE SE SW Sec. 15-5s-6 ..... Shut down 2,170 ft.

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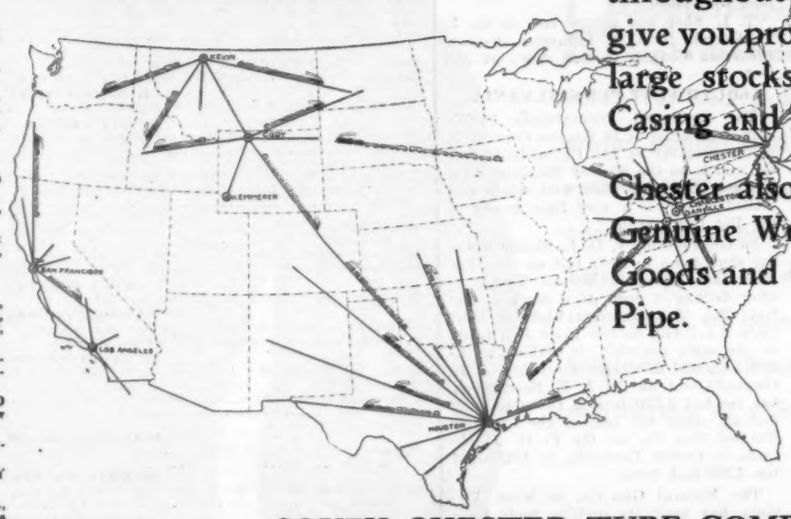

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ROCKY MOUNTAIN AREA

(Continued from Page 39)

acquired at much lower prices, but there is comparatively little trading. Royalties, on the other hand, are showing an increased demand. The beginning of one well and the announcement that several others are to be drilled this summer has stimulated interest and from now on it is predicted there will be a steady increase in activity. The key to the situation appears to be that the operators are convinced a major oil pool exists in that area, but that it is no time to bring it into production. The result has been that the major companies, fortified with long-time leases, have held off on drilling. The appearance of several independents with drilling programs threatens to upset this plan, especially if some of the wells are spaced so as to require offsetting. Fort Morgan, where most of the scouts make their headquarters, is convinced it is on the eve of important developments and is making arrangements for a landing field for airplanes, making an inventory of accommodations of outside people and preparing for what may come. Reiter-Foster Oil Co., which is drilling the only well now going down, is making surveys for a pipe line from Greasewood to the Union Pacific Railroad at Orchard, a distance of 12 to 15 miles. The line probably will follow the west boundary of Morgan County and will consist of 6-inch pipe. Construction probably will not start until its well is nearing the sand.

Reiter-Foster Oil Co.'s No. 1 Ida Johnson, C NE NW, Section 24-6n-61, which offsets the discovery well on the north, is drilling below 4,000 feet. It is a joint operation with Platte Valley Petroleum Corp. and is being drilled with rotary equipment. It topped the Hygiene sand at 3,104 feet, according to the drillers' log, but did not stop as the formation had only a slight show of oil. It is supposed to be running about 35 feet higher than the discovery well, but allowances have to be made for the differences due to different drilling methods, the discovery well having been put down with cable tools. Nothing of importance is expected in this well for some time and rotary bit will be used to about 6,400 feet when change over to cable tools will be made.

Aztec Corp., organized by Miller Robert Taylor, was incorporated under the laws of Colorado this week. The directors are Wirt Franklin, Harry Franklin and J. I. Cromwell, Mid-Continent operators who are also officers of the Capitol Drilling Co., with which the company has made contracts for two wells, John F. Howard, Mortimer D. Bowen, P. H. Coeur and E. M. Fox. One well is to be drilled on the east half of Section 1-6n-61, a little more than 2 miles north of the discovery, and the other on Section 16-6n-61, the same distance to the northwest. Both are to be drilled with rotaries, are to commence spudding July 1 and are to be carried to 7,500 feet, if necessary.

Morgan County

Indian Territory Illuminating Oil Co.'s No. 1 State, C NE NE, Section 16-1n-57, on the Fort Morgan anticline, 18 miles southeast of the Greasewood operation, is to be completed with rotary tools. The well spudded in March, 1930, with cable tools, and reached 4,090 feet several months ago. It had all kinds of trouble with casing freezing and cavey ground and it became apparent it could not be finished with cable tools. The hole so far has been in the Pierre shale practically all the way down and it probably will have to go to 5,500 feet or more to reach the objective Dakota.

Arapahoe County

MacDeb Drilling Co.'s No. 1 Fitzsimmons, C S half NE, Section 7-4s-66, near Aurora, is shut down at 5,835 feet in sand to run 4¾-inch pipe. It is about 20 feet in an unidentified sand. In the top of the sand about 2 inches of oil was showing on the water, but when drilled deeper and allowed to stand, as much as half a bailer full of oil has been brought to the surface. The oil is much better grade than the showing at 5,735 feet and tests 54 degrees gravity against 34 for the upper show. If these shows are in the Hygiene, as some geologists contend, the well will have to go to around 8,500 feet to reach the Dakota.

Adams County

Nettie M. Slatt's No. 1 Hills, SE cor., Section 27-3s-64, is drilling at 3,520 feet in shale. The color of the shale is gradually turning to a brownish tint.

Jefferson County

Ruby Hill Oil & Gas Co.'s No. 1 Braden, SE cor., Section 24-4s-69, near Denver, is drilling at 3,910 feet in a hard sandstone. The small show of gas which has been apparent for some time slightly increased at this depth.

Baca County

A. R. Jones Oil & Operating Co.'s No. 1 Boice Cattle, NW NE, Section 22-34-42, near the Kansas line, is bottomed at 4,965 feet and sidetracking 400 feet of the 4¾-inch which parted.

Park County

South Park Oil & Gas Co.'s No. 1 Esche, SE cor. NW, Section 5-9s-76, Muleshoe Dome, is drilling at 2,340 feet in very hard rock. It is making considerable gas, but no oil and no water. Several geologists who visited the well the past week express the opinion it is deeper geologically than supposed and the next 300 feet may put it into the Dakota. South Park Oil Co.'s No. 1 Milligan, NE cor. SE, Section 13-8s-76, Jefferson district, is drilling at 2,020 feet with 8¼-inch landed for a water shutoff, but not cemented. at 2,010 feet.

Grand County

Oil & Mineral Lands, Inc.'s No. 1 McElroy, SE SW, Section 14-2n-81, Kremmling district, is shut down at 545 feet.

Huerfano County

Alamo Oil Co.'s No. 1 fee, CNL NW SE, Section 4-28-68, Badito-Alamo Dome, is shut down at 4,115 feet and Ross Cooper is reported in the Hobbs Field in New Mexico negotiating for a rotary rig with which to start a new hole from the top. This well was started by the Parker Club, Inc., in 1928 as a joint operation with the Kinney-Coastal Oil Co. At its present depth it had a show of gas and oil in the top of the Lakota, but completion has been impossible due to parted pipe and tools in the hole and inability to get cement to set. The new company was formed some time ago to take over the operation. If a new hole is started, it probably will be carried down to test the Pennsylvanian formation.

Fremont County

Waterville Oil Co.'s No. 1 State, SE cor. NW, Section 16-18-69, north of the Florence Pool, is drilling at 1,400 feet. It started in the red beds.

La Plata County

Murchison Oil Co.'s No. 1 Doescher, SW cor. NW, Section 29-33-13w, Dry Mesa, shut down for the winter at 1,225 feet, is preparing to resume. Crew will be brought from a well now being completed in the Kutz Canon district in New Mexico. Detroit Oil Association's No. 1 Olbert, NW SW, Section 9-35-12, Thompson Park, is shut down at 3,125 feet.

Montezuma County

Fred C. Haller's No. 2-A Carr, NW cor. SW, Section 33-36-14w, Point Lookout, was abandoned at 745 feet after encountering water in the top of the Dakota.

Rio Blanco County

California Co.'s No. 1 California-Ragan, NW SE, Section 30-2n-102, Rangely Dome, commenced spudding May 19 and cemented 28-inch conductor pipe at 30 feet. This is one of the most important wildcats in the State and elaborate arrangements have been made for a thorough test of the deeper horizons on this structure. A 138-foot combination steel derrick, two Deisel engines and some of the best machinery ever brought into the State form part of the equipment. The Weber, or Tensleep formation of Pennsylvanian age is the major objective. Magnolia Petroleum Co.'s No. 1 Maddock, C NW SE, Section 9-2s-96, Piceance Creek, is building rig.

Larimer County

Mosher & Hutcheson's No. 1 Hall-Hogsett, SE NE, Section 20-4n-69, Berthoud Dome, is rigging up, and Pearl J. Mosher's No. 1 Mead, SE NW NE, Section 20-4n-69, is rigging up machine. Vogel-Raddatz Corp.'s No. 1 Red Rock School, NE cor., Section 20-4n-69, is erecting machine. It will go only to the gas sand expected at around 700 feet. Last named firm is loading rig at Amarillo for No. 2 State, C NW, Section 16-4n-69. The last two named are joint with the Standard Oil Co. of Colorado. Standard's No. 1 Wilson, NW cor. SW, Section 21-4n-69, is standing at 1,220 feet.

WYOMING

Weston County

An important extension of the Osage Field in northeastern Wyoming was reported this week in Hugh Updike's No. 1, CEL SW NW, Section 23-46-64, flowign 100 bbls. natural per day from sand at 1,820-33 feet. It was still in hard saturated sand when drilling stopped. A shot probably would increase production considerably, but on account of market conditions it will not be shot until an improvement is apparent. The location is about 3,000 feet southwest of the nearest producer in the NE of Section 23 and a little farther southwest of the group of producers in Section 14. The elevation of the Updike well is 4,082 feet and sand conditions resemble those in the northeast corner of the section. This well, like those in Section 14, are outside of the productive area as outlined in 1921 in Bulletin 766 of the United States Geological Survey. Osage drilling operations include the following:

Clark and others' No. 1, SE NE NE, Section 15-46-64, is drilling at 1,750 feet, and Tom Don's No. 2. NW cor. SE. Section 23-46-64, is drilling at 1,200 feet. Yellowstone Petroleum Co.'s No. 1, NE cor. NW, Section 23-46-64, is drilling at 1,400 feet. Wytex Oil Co.'s No. 5 Logan McCullough, SW NE NE, Section 23-46-64, is drilling at 500 feet, and B. V. Hole and others are drilling at 300 feet in the SW SW, Section 9-46-63.

Niobrara County

Indian Petroleum Co.'s No. 1, NE NW NE, Section 7-35-65, Lance Creek, which is being deepened to the Sundance at 4,200 feet, is drilling at 3,911 feet.

Converse County

Continental Oil Co.'s No. 50 Whiteside, NW SW SW, Section 9-33-76, Big Muddy, is rigging up to deepen to the Lakota.

Natrona County

Midwest Refining Co.'s No. 11 Middy, C NE NE. Section 23-35-79, Midway Dome, is still plugging back from a total depth of 6,685 feet to 6,505 feet.

Park County

Resolute Oil Co.'s No. 1, NE SW NE, Section 17-57-101, Badger Basin, is drilling slowly below 8,537 feet in the second Wall Creek and flowing about 75 bbls. per day of very high gravity oil. Grebo Royalties, Inc.'s No. 1 McGrath, NE cor. SE, Section 3-47-100, Little Buffalo Basin, set the 12½-inch at 836 feet and is waiting. Midwest Refining Co.'s No. 24 Rosenberg, NE SE NE, Section 26-58-98, Frannie Dome, is building rig.

Big Horn County

Ohio Oil Co.'s No. 1 Smith, NE SE SE, Section 33-56-97, Garland Dome, is drilling at 1,703 feet. Utah Southern Oil Co.'s No. 3 Government, NE cor. SW, Section 29-56-97, is drilling at 3,820 feet, and F. T. Griffith, trustee's No. 1, SE NE SE, Section 29-56-97, is drilling at 2,800 feet.

Washakie County

Ohio Oil Co.'s No. 1 Strothers, SW SE NW, Section 19-45-92, Neiber Dome, is drilling at 4,790 feet.

Fremont County

Producers & Refiners Corp.'s No. 10, SE NW SW, Section 14-32-95, Big Sand Draw, the deep test, is nearing the completion stage. It is bottomed at 5,345 feet and is circulating. It has tested all sands down to and including the Sundance. Nothing of value was found in the Sundance and it will plug back to the pays in the upper horizons and save as a gas well. Same company's No. 2, NW SE NW, Section 33-34-92, Muskrat Dome, is drilling at 5,565 feet in hard blue shale.

Carbon County

Producers & Refiners' No. 1, SW cor., Section 19-20-83, Overland Dome, is drilling at 152 feet with the 6-inch at 82 feet, and its No. 1, NE SE NE, Section 7-25-86, South Ferris, is bottomed at 2,030 feet and repairing machine. Both of these wells are wildcats. Midwest Refining Co.'s No. 27 Union Pacific, NW SE SE, Section 11-20-81, is drilling at 2,345 feet in light gray shale. It still has more than 1,000 feet to go to reach the objective Dakota.

Laramie County

Prairie Oil & Gas Co.'s No. 1 Warren, SE NE SE, Section 22-13-68, southwest of Cheyenne, is rigging up. This is expected to be a rather deep test.

Sweetwater County

Mountain Fuel Supply Co.'s No. 1 Cappers, SW cor. NE, Section 2-19-104, North Baxter Basin, which showed for 2,000,000 feet of gas and 20 to 25 bbls. of high gravity oil after two shots at a total depth of 3,660 feet, did not do so well when tested. It made about one-half a barrel of oil and no gas. After bailing down it filled 500 feet with water and probably will be abandoned.

Sublet County

Thomas B. Jefferson's No. 1, Section 11-28-113, Dry Piney, is drilling at 2,140 feet with the objective expected in the next 60 feet. This well is financed by Japanese capital.

MONTANA

Glacier County

The four wells to be drilled in the Cut Bank Field on acreage recently acquired by the Montana Power Co. from L. B. O'Neil and associates, for the development of a gas supply for Butte, Helena, Anaconda and other towns, all spudded the past week and are drilling at around 100 feet. L. B. O'Neil, as agent for the new interests, will be in charge. The wells are as follows: No. 1 Taylor & Spikes, C SW SW, Section 35-36-5w; No. 1 State, C SE NW, Section 34-36-5; No. 1 State, C NW NW, Section 33-36-5; and No. 1 Schneider, C NE SE, Section 32-36-5. Glacier Oil Co.'s No. 1 Olmsberg, NE cor. NW, Section 33-35-5w, Headlight district, is shut down at 2,805 feet. It had 1,500,000 feet of gas per day at 2,727 feet. Gordon Campbell is interested. Fulton Petroleum Co.'s No. 1 Blackfeet, SW NE NE, Section 28-36-12w, Milk River district, is drilling at 1,680 feet after cementing the 16-inch at 1,600 feet. B. & H. Oil Co.'s No. 1 Haines, C SE SE, Section 2-34-6w, Headlight Butte, is bottomed at 2,785 feet and testing sand. It is swabbing around 50 bbls. per day. B. & H. Oil Co.'s No. 1 Yunck, NE SE SW, Section 23-34-6w, is spudding.

Toole County

Askalta Oil Co. has acquired 30 acres in the SE NE of Section 2-37-4w, in the Border Field, from the Mid-Continent Oil & Refining Co., including No. 3 Farbo, SE cor. NE, Section 2-37-4w, upon which rig has been standing without spudding for some time. An organization called the Alberta Drillers has taken over the Nellie B. Oil & Gas Co.'s No. 1 Farbo, NE SE SE, Section 3-37-4w, and will complete same. It has been standing for several months at a total depth of 1,350 feet.

In the Barthelote district, Oregon Oil Syndicate has rig up for a well in the SW NE SE, Section 20-36-2e. Liquid Gold Oil Co.'s No. 1 Roberts, C NW NE, Section 25-36-1e, is drilling at 2,420 feet.

Liberty County

G. G. Howard's No. 1 Schoonover, NW NW, Section 18-36-6e, Bear's Den, is bottomed at 2,345 feet and testing. It made 6,250,000 feet of gas and 10 bbls. of oil in 24 hours. The gas was at 1,944-2,000 feet and the oil at 2,202-47 feet. Northland Oil & Gas Co.'s No. 1 Yurman, C SE SW, Section 32-33-5e, Liberty Dome, is drilling at 3,610 feet in the base of the Madison lime.

Carbon County

Ohio Oil Co.'s No. 1 Montana Industrial, SE SW NE, Section 11-7s-21, Dry Creek, is drilling at 5,385 feet and is about due to enter the top of the objective Dakota formation. It is a north offset to the discovery in that horizon. The same company's No. 1 Souders, C SW SE, Section 2-7-21, is drilling at 3,155 feet. Carbon Oil & Gas Co.'s No. 1 Armstrong, SW cor. NW, Section 7-7-22, set 13⅜-inch at 2,326 feet and will change over to rotary tools at this depth.

Rosebud County

Prairie Oil & Gas Co.'s No. 1-X, N. P. 3, NE SW NW, Section 26-10n-39, Porcupine Dome, is bottomed at 2,415 feet and drilling by whipstock at 1,890 feet.

Teton County

California Co.'s No. 1 Sullivan, NW NE NW, Section 34-27-7w, Bynum-Pen-

dry district, spudded to 35 feet and shut down to complete rigging.

UTAH

Utah Southern Oil Co.'s No. 1 Balsey, C NE NE, Section 31-23-21, Salt Valley, has encountered more salt and is drilling in that formation at 3,200 feet. Diamond Oil Co.'s No. 1, SE NW, Section 16-8s-5e, Utah County, is drilling at 3,256 feet in sand and lime.

ARIZONA

Benedum-Trees' No. 1 Arzberger, NW cor. SE, Section 19-15s-26, 18 miles southeast of Willcox in Cochise County, is drilling below 1,000 feet in reddish brown clay. San Simeon test on the Torrance Ranch, SE cor. NE, Section 27-13s-30, encountered hot water in red sand at 4,056 feet and is preparing to underream and lower the 6¼-inch for a shutoff. Geronimo Oil Co.'s No. 1 Clark-Halladay, Section 6-14-25, in the town of Willcox, is preparing to resume at 436 feet and will be drilled to 700 feet, and its No. 1 Bruning, same section, is bottomed in sand at 783 feet with a show of oil.

Rocky Mountain Fields

Average daily production in week ending May 30:

WYOMING	
Salt Creek	24,780
Big Muddy	1,830
Byron	10
Dallas-Derby	650
Dutton Creek	80
Elk Basin	690
Ferris	30
Frannie	910
Grass Creek	2,060
Hudson	900
LaBarge	1,160
Lance Creek	250
Lost Soldier	3,870
Lovell	....
Oregon Basin	1,440
Osage	1,290
Rock River	1,950
Poison Spider	170
Simpson Ridge	....
South Casper	....
Teapot	20
Warm Springs	....
Total	41,490
MONTANA	
Buckley-Border	700
Cat Creek	1,030
Dry Creek	510
Kevin-Sunburst	4,420
Lake Basin	50
Ponders	1,940
Total	8,650
COLORADO	
Florence	450
Fort Collins	1,020
Iles	950
Moffat	890
Orchard	350
Rangely	20
Tow Creek	330
Total	4,050
NEW MEXICO	
Rattlesnake	1,025
Hogback	460
Table Mesa	81
Artesia	1,154
Cap Rock	200
Getty	300
Hobbs	38,812
Jal	1,105
Lea City	2,550
Eunice	502
Texas-Pacific area	....
Total	46,229
Total Rocky Mountain fields	100,419
Total previous week	98,205
Difference	2,214

OIL MAN'S CALENDAR

JUNE

5—Fort Worth, Tex., A.P.I. Board of Directors, Texas Hotel.

8-11—Toronto, Canada, National Association of Purchasing Agents, Royal York Hotel.

9-11—Chattanooga, Tenn., Natural Gasoline Department, American Gas Association.

10-12—Swampscott, Mass., American Institute of Chemical Engineers.

15-18—Madison, Wis., fourth national oil and gas power meeting, American Society of Mechanical Engineers.

15-19—White Sulphur Springs, W. Va., summer meeting, Society of Automotive Engineers.

18-19—Charleston, W. Va., West Virginia Oil Marketers Association, Daniel Boone Hotel.

22-26—Chicago, annual meeting, American Society for Testing Materials.

29-30—Chicago, National Association of Taxicab Owners.

AUGUST

10—Denver, Colo., Oil States Advisory Committee.

SEPTEMBER

1-3—Cleveland, Ohio, twentieth national aeronautic meeting, Society of Automotive Engineers.

16-18—Atlantic City, N. J., annual meeting, National Petroleum Association, Hotel Traymore.

28-29—Atlantic City, N. J., National Association of Motor Bus Operators, Hotel Ambassador.

OCTOBER

2-3—Houston, Tex., Petroleum Division, American Institute of Mining and Metallurgical Engineers.

12-16—Chicago, National Safety Council.

14-16—Pittsburgh, Pa., Society of Industrial Engineers.

NOVEMBER

10-12—Chicago, twelfth annual meeting, American Petroleum Institute, Stevens Hotel.

16-21—Pittsburgh, Pa., third International Conference on Bituminous Coal, Carnegie Institute.

DECEMBER

7-12—Atlantic City, N. J., Trade Show, Motor and Equipment—National Standard Parts Association.

28-31—Tulsa, Geological Society of America, Mayo Hotel.

PIPE LINE PROJECTS IN EAST TEXAS AREA

(Continued from Page 48)

being that of Sun Pipe Line Co. and Yount Lee Oil Co., already under construction.

Sinclair-Texas Pipe Line is progressing rapidly on its acetylene welded 12-inch main line from the Kilgore area in northern Rusk County to Colonels Station near Mexia, and is now welding the line near Troup, and also in the Joiner Pool. The company is also laying gathering lines which will be connected to this main trunk line, the gathering lines being arc welded. Sixteen miles of such gathering lines have been laid from Kilgore to Willow Springs and the Gladewater area. The A. F. Day Construction Co. at Dallas has been doing the welding on the 16 miles of gathering line out of Kilgore.

S. & S. Oil Co. has started construction of a 50-car loading rack at Longview.

INDIAN BUREAU APPEAL ON OSAGE OIL INCOME

WASHINGTON, D. C., May 30.—The Indian office will appeal to the owners of land, from which the Osage Tribe derives its oil income, to permit payment of royalties to the Indians during litigation to determine ownership of the petroleum.

Commissioner Rhoads said the appeal would be made on humanitarian grounds. The Osages, classed among the wealthiest peoples of the world because of the enormous income they have received during the past 15 or 20 years, face the prospect of very real misery, possibly hunger, if the royalties are tied up during a possible two years of court proceedings.

Their present income, the Indian office says, is about $175,000 a month. A quarterly payment is due next month on royalties accrued before the expiration of the first law which gave the minerals under the service to the tribe as a whole.

After that there will be no money to be paid out unless those who contest the constitutionality of laws extending that mineral right agree not to seek reimbursement of royalties during the litigation period. The majority of the tribe have no other source of income.

CORNING GAS FIELD POTENTIAL BUILT UP TO 411,000,000 FEET

CORNING, N. Y., May 30.—The Allegany Gas Co.'s No. 1 Learn, in Farmington Township, in the Tioga Field, in Pennsylvania, the company's third gas well, started at 22,000,000 feet. This is the tenth gas well in the Tioga side of the big Corning gas area. The company completing it opened the Tioga Field. Its three wells have a combined potential of 42,000,000 feet of gas a day and the 10 wells in the field are credited with a total potential of 213,000,000 feet. Half dozen wells in the Tioga Field, all of them located favorably, were due for completion in the very near future and expected to greatly increase the potential production of the field.

On the New York State side of the field the Wayne-Dundee area in Schuyler and Yates Counties is good for 198,000,000 feet of gas from the wells already in. There are 39 wells in the field, 14 of which are in the Wayne and 25 in the Dundee area. Three wells were ready for completion in the area when this was written.

Two wells were added to the Wayne Field in the past week in review. These were the Belmont Quadrangle Drilling Co.'s No. 1 Lent, good for 5,000,000 feet and the J. T. Cunningham Oil & Gas Co.'s No. 2 Gleason good for 4,000,000 feet.

The 8-inch pipe line of the Belmont Quadrangle Drilling Co. from the Dundee to the Wayne gas field is complete and gas has been turned into it and it is being tested for leaks. The Wayne-Dundee Field is located in the area that corners Steuben, Yates and Schuyler Counties. A complete network of lateral lines will serve the two fields and the main line will supply a general gathering system to be connected to lines that will carry the fuel to outside markets.

The Belmont Quadrangle Drilling Co. is partly owned by the Columbia Gas & Electric Co. It is currently reported that the Columbia Company will eventually lay a line to Jersey City, N. J. The Lycoming Natural Gas Co. is reported to be negotiating with gas producers in the Wayne Field and that it will pipe gas into Syracuse.

TOO MUCH OIL

An area in Mexico almost flowing in petroleum, rich in gold, lead and silver, and inhabited by wild Tlapanec and Mixtec Indians, was described by Miss Anita Brenner, author, on her return to Mexico City from a four months' trip into remote areas of Guerrero and Oaxaca states.

Sponsored by the Guggenheim Foundation to study primitive Mexican Indian life and art, Miss Brenner and her husband, Dr. David Glusker of Brooklyn, traveled through the region, which is only about 400 miles from Mexico City.

"For an area of 300 miles," Miss Brenner related, "this country is tremendously rich in minerals and oil.

"In that whole great area we did not encounter a single river or spring where the waters were not polluted by oil seepage. Petroleum drips from the hillsides, there are asphalt seepages everywhere, good anthracite coal can be picked up and lead can be cut from the rocks."

NATURAL GAS CONVERSION

CHATHAM, Ontario, June 1.—In a paper read at the convention of the Royal Society of Canada at Toronto, Dr. M. C. Boswell and A. M. Boultbee of the department of chemical engineering, University of Toronto, outlined new schemes for utilizing the waste gas of the Turner Valley. The chemists have demonstrated the successful conversion of the natural gas into carbon monoxide and hydrogen which have a practical use in many industrial applications. Before the processes can be applied commercially, the cost aspects of the operation must be studied.

WILDCAT OPERATIONS IN WEST TEXAS

(Continued from Page 46)

EL PASO COUNTY

Lane-The Texas Company's No. 1 Malone, 2,110 ft. from SW and NW of Sec. 46, J. M. Day Sur. ..... Shut down 3,089 ft.
Tri-State Oil Co.'s No. 1 Bobadella, 1,325 ft. from S and E lines Sur. 254, S.F. No. 7,247 ..... Shut down 677 ft.

FISHER COUNTY

Stanolind Oil & Gas Co.'s No. 2 Steele, 1,200 ft. E and 330 ft. N of SW cor. Sec. 210, B.B.B.&C. Sur. ..... Top lime 1,600 ft.; shut down 3,015 ft.; show oil 2,924-34 ft.
The Texas Company's No. 1 Jean, 330 ft. from E and 400 ft. S of Sec. 201, Blk. 1, B.B.B.&C. Sur. ..... Shut down 1,445 ft.

GAINES COUNTY

Landreth Prod. Co.'s No. 1 Alley, 660 ft. from N and W of Sec. 2, Blk. A-36, P.S.L. Sur. ..... Drlg. 2,365 ft.
Texas Consolidated Oil Co. et al's No. 1 Jones, 2,310 ft. from NE Sec. 4, Blk. A-5, P.S.L. Sur. ..... Shut down 3,435 ft.

GARZA COUNTY

Pandem Oil Corp.'s No. 1 Justice, 330 ft. from S and W of Sec. 13, Blk. 4, H.&G.N. Sur. ..... Spudded and shut down.
Perry & Posey's No. 1 Justice, 1,980 ft. from S and 1,650 ft. from E of Sec. 25, Blk. 6, H.&G.N. Sur. (3,500-ft. cable tool test) ..... Shut down 2,980 ft.

HOWARD COUNTY

Continental Oil Co.'s No. 1 Brindley, 660 ft. from S and E of Sec. 13, Blk. 33, Twp. 1s, T.&P. Sur. ..... Drlg. 3,285 ft.
Green O. & R. Co.'s No. 1 Denman, 990 ft. from S and 2,310 ft. from W Sec. 14, Blk. 29, Twp. 1s, T.&P. Sur... Spudded and shut down.

HUDSPETH COUNTY

Henshaw's No. 1 Love, C NE Sec. 9, Blk. 67½, P.S.L. Sur. ..... Drlg. 330 ft.
Patillo & Welch's No. 1 Briggs, 300 ft. from S and W Sec. 13, Blk. 73, Twp. 7, T.&P. Sur. ..... Shut down 690 ft.
Theison's No. 1 University, 3,050 ft. from S and 3,225 ft. from E of Sec. 17, Blk. E ..... Spudded 35 ft. and shut down.

IRION COUNTY

Central Oil Co.'s No. 2 Horney, 150 ft. from N and 1,320 ft. from W Sec. 2, Blk. 2, H.&T.C. Sur. ..... Preparing to plug at 1,600 ft.
Davis et al's No. 1 Suggs, 1,560 ft. from S and 925 ft. from W, Sec. 3,081, Blk. 28, H.&T.C. Sur. ..... Running 15½-in. casing 490 ft.
Dixie Oil Co.'s No. 1 Williams, 1,320 ft. from S and E of Sec. 1,196, T.T.R.R. Sur. ..... 300 ft. oil in hole from 4,155-61 ft.; shut down 5,945 ft.
Fox's No. 1 Horney, 1,520 ft. from N and 1,525 ft. from W Sec. 2, Blk. 3, H.&T.C. Sur. ..... Drlg. 1,367 ft.
Straughn & Texannati Oil Co.'s No. 1 Tankersley, 150 ft. from S and 750 ft. from W of Sec. 4, Gonzales County School Land ..... Plugged back to 1,333 ft.; total depth 1,506 ft.

JONES COUNTY

Abers et al's No. 1 Burton, 150 ft. from S and 175 ft. from E of 43.4-acre tract in G. Martinez Sur. ..... Running 10-in. casing 528 ft.
Barney & Duffy's No. 2 King, 3,700 ft. from N and 200 ft. from E, Subd. No. 18, M. Bueno Sur. ..... Location.
Union Oil Co.'s No. 2 King, 4,100 ft. from N and 200 ft. from E, Subd. 18, Bueno Sur. ..... Material.
Andy Urban's No. 1 Riddle, 200 ft. from S and 150 ft. from E, Subd. 2, A. W. Hill Sur. ..... Top pay 1,700 ft.; total depth 1,718 ft.; swabbed 35 bbls. in 2 hours and swabbed down; filled up 1,000 ft.

Young & McNeil's No. 1 L. R. Cade, 150 ft. from N and 450 ft. E of NW cor. of J. A. Williams 200-acre tract in Sec. 17, but in Sec. 12, Blk. 19, T.&P. Sur. ... Drlg. 2,456 ft.

LOVING COUNTY

Eppenauer et al's No. 2 Allen, 2,310 ft. from NE and 330 ft. from NW Sec. 90, Blk. 1, W.&N.W. Sur. ... Drlg. 4,310 ft.; show oil 4,270 ft.
Ervin & Mahres' No. 1 Thrope, 2,310 ft. from E and 330 ft. from S Sec. 46, Blk. 53, T.&P. Sur. ... Shut down 810 ft.
Ervin & Mahres' No. 1 Meyer, 990 ft. NE and 330 ft. SE of Sec. 3, Blk. 2, W.&N.W. Sur. ... Location.
Falbre & Evans' No. 1 Dean, 330 ft. from NE and 990 ft. from NW Sec. 79, Blk. 33, H.&T.C. Sur. ... Shut down 1,465 ft.
Hoffman et al's No. 2 Ramsey et al, 2,310 ft. from NE and 330 ft. from SE Sec. 33 ... Drlg. 3,415 ft.
Irwin et al's No. 1 Auld, 1,825 ft. from NE and 1,398 ft. from NW Sec. 67, Blk. 1, W.&N.W. Sur. ... Rig up.
Lockhart & Co.'s No. 3 Bowen & Wells, 330 ft. from NE and SE of Sec. 92, Blk. 1, W.&N.W. Sur. ... Shut down 4,050 ft.
Lockhart & Co.'s No. 2 fee, 676 ft. S, 330 ft. W Sec. 91, Blk. 1, W.&N.W. Sur. ... Rigged up and shut down.
Lockhart's No. 1 Bell, 1,721 ft. from NE and 410 ft. from SE Sec. 91, Blk. 1, W.&N.W. Sur. ... Shut down 4,262 ft.; plugged back to 4,262 ft.; top pay 4,226 ft.; flowed 472 bbls. in 24 hours after 160-qt. shot.
Martin et al's No. 1 Johnson, 1,330 ft. from NW and 330 ft. from SW Sec. 86, Blk. 1, W.&N.W. Sur. ... Location.
Richmond Drlg. Co.'s No. 1 Russell, 990 ft. from NE and 330 ft. from NW Sec. 30, Blk. 31, W.&N.W. Sur. ... Drlg. 3,642 ft.
Rush et al's No. 1 Wheat, 330 ft. from NW and SW Sec. 77, Blk. 1, W.&N.W. Sur. ... Cellar.
Siagel Drlg. Co.'s No. 1 Cartwright et al, 2,310 ft. from S and 990 ft. from W Sec. 1, Blk. 57, Twp. 1, T.&P. Sur. ... Total depth 3,183 ft.; plugged back to 3,174 ft.; unable to get water shut off.
W. A. Suddreth et al's No. 1 Capitola Pool, 2,970 ft. from NE and 990 ft. from NW Sec. 73, Blk. 33, H.&T.C. Sur. ... Drlg. 175 ft.; elev. 2,644 ft.
Tennant et al's No. 1 Martin, 990 ft. from NW and SW Sec. 66, Blk. 1, W.&N.W. Sur. ... Drlg. 680 ft.
California Co.'s No. 3 Allen, 2,191 ft. from NW and 2,182 ft. from SW Sec. 90, Blk. 1, W.&N.W. Sur. ... Drlg. 3,887 ft.
California Co.'s No. 4 Allen, 3,121 ft. from NW and 3,113 ft. from SW Sec. 90, Blk. 1 ... Top salt 855 ft.; drlg. 3,342 ft.

MENARD COUNTY

Priest's No. 1 Sorrel, 1,000 ft. from E and 200 ft. from S cor. Sec. 132, E.L.R.R. Sur. ... Drlg. 2,840 ft.

PECOS COUNTY

Dittman's No. 1 Sanford, 330 ft. from NW and 1,650 ft. from NE of Sec. 55, Blk. 10, H.&G.N. Sur. ... Location.
Honolulu Oil Co.'s No. 1 Webb, 3,140 ft. from N and 1,000 ft. from W of Sec. 105, Blk. OW, G.S.&S.F. Sur. ... Drlg. 1,452 ft.
J. R. Miller et al's No. 1 Bennett, 359 ft. W of CWL Sec. 1, Blk. 119, G.C.&S.F. Sur. ... Shut down 2,383 ft. for casing.
Penn Oil Co. et al's No. 1 Alvis, 2,358 ft. from S and 1,327 ft. from W Sec. 155, Blk. 3, T.&P. Sur. ... Show oil 3,601-02 ft.; drlg. 3,651 ft.
Perren Oil Co.'s No. 2 Eaton, S of E Sec. 27, Blk. 3, H.&T.C. Sur. ... Fishing 1,765 ft.
Pure Oil Co.'s No. 1 Harrison, 2,310 ft. from N and 330 ft. from W of Sec. 203, Blk. 3, T.&P. Sur. ... Shut down 5,000 ft.
California Co. et al's No. 1 Thomas, 990 ft. from NW and SW Sec. 31, Blk. 34, H.&T.C. Sur. ... Location.
Whitaker et al's No. 1 Mary Devlin, 150 ft. from N and 150 ft. from E Sec. 69, F. Hernandez Sur. ... Shut down 430 ft.

REEVES COUNTY

R. T. Hansford's No. 1 Williams, 150 ft. from S and W Sec. 17, Blk. 6, H.&G.N. Sur. ... Shut down 580 ft.
Humble Oil & Ref. Co.'s No. 1 Bolmorhea Livestock Co., 1,320 ft. from N and 1,320 ft. from W Sec. 33, Blk. 5, H.&G.N. Sur. ... Drlg. 991 ft.
Lee O. White et al's No. 1 Hershersor, 330 ft. from N and W lines of Sec. 5, Blk. 51, Twp. 10, T.&P. Sur. ... Shut down 4,525 ft.

RUNNELS COUNTY

Dutton et al's No. 1 Dean, 5,475 ft. from NE and 1,048 ft. from NW in J. Heil Sur. No. 419 ... Shut down 2,335 ft.; testing water shutoff.

SCHLEICHER COUNTY

Eastland Oil Co.'s No. 1 Joe Tisdale, C Sec. 29, Blk. M, G.H.&S.A. Sur. ... Shut down 2,509 ft.
Wesner et al's No. 1 Nicks, 2,310 ft. from N and 2,362 ft. from E of Sec. 77, Blk. LL, T.C. Sur. ... Shut downn 4,006 ft.
George Wilson's No. 1 Page, Sec. 40, Blk. L, 1,290 ft. from N, 1,570 ft. from W, G.H.&S.A. Sur. ... Shut down 5,053 ft.

SCURRY COUNTY

G. E. Dickman and R. B. Pender et al's No. 1 F. C. Davis, 1,000 ft. N and 1,770 ft. W of SE cor. of Sec. 275, Blk. 2, H.&T.C. Sur. ... Shut down 5,100 ft.
Scurry County Oil Exchange's No. 1 Earnest, 2,310 ft. from N and W Sec. 68, Blk. 3, H.&G.N. Sur. ... Spudded and shut down.
Seifert & Dibble's No. 1 T. M. Blackburn, 2,310 ft. from N and 2,310 ft. from W line of Sec. 153, Blk. 97, H.&T.C. Sur. ... Shut down 3,375 ft.
Simon & Brock et al's No. 1 Cruse, 2,310 ft. from S and E Sec. 119, Blk. 97, H.&T.C. Sur. ... Shut down 515 ft.

TAYLOR COUNTY

John B. Jamason's No. 1 Webb, 1,170 ft. S and W of NE cor. Sec. 46, Lunatic Asylum Land ... Shut down 6,396 ft.
Sanger et al's No. 1 City of Abilene, 330 ft. from S and 1,400 ft. from E of Sec. 66, Blind Asylum Land ... Shut down 2,785 ft.

TERRELL COUNTY

Big Bend Oil Co.'s No. 1 Bassett, C NW Sec. 155, Blk. D, M.-K.-T. Sur. ... Shut down 2,669 ft.
Keck Pecos Trust Co.'s No. 1 Hamilton, C Sec. 6, Georgetown Ry. Sur. ... Shut down 3,150 ft.
Miller Bros. No. 1 Allison & Burke, C NW cor. Sec. 10, Blk. 176, T.&P. Sur. ... Shut down 120 ft.
Mid-Kansas Oil & Gas Co.'s No. 1 Goode, 2,152 ft. from E and 330 ft. from S Sec. 26, Blk. 161, G.C.&S.F. Sur. ... Shut down 6,120 ft.
Jones et al's No. 1 Pankenham, C SE NW Sec. 43, Blk. B-3, C.C.S.D.&R.G.N.G. Sur. ... Shut down 1,075 ft., total depth (corrected).

TOM GREEN COUNTY

Belding & Dutton's No. 1 Norsworthy, 2,640 ft. from S and 587 ft. from E of John McNeese Sur. ... Shut down 760 ft.; show oil and gas 725 ft.
Mintex Oil Co.'s No. 1 Campbell Est., 446 ft. from S and 630 ft. from W of Sec. 180, Dist. No. 11, S.P. Sur. ... Shut down, 1,994 ft.
Pratt & Hancock's No. 2 Lewis, 100 ft. N and 330 ft. E of most northerly SW cor. of Joshua S. Grant Sur. No. 2 ... Shut down 200 ft.

UPTON COUNTY

Mintex Oil Co.'s No. 1 Lane, 2,310 ft. from N and 1,650 ft. from W Sec. 36, Blk. 1, M.-K.-T. Sur. ... Shut down 2,134 ft.
Rankin et al's No. 1 Cordova Union Land, 660 ft. from N and E Sec. 6, G.C.&S.F. Sur., 1¼ miles S of Rankin ... Building rig.

VAL VERDE COUNTY

Independent Operators' No. 1 Whitehead, SE SE Sec. 10, Blk. 4, I.&G.N. Sur., elev. 1,175 ft. ... Shut down 5,420 ft.
O. O. Owens' No. 1 Mills, Sec. 128, Blk. 1, I.&G.N. Sur., elev. 2,130 ft. ... Shut down 6,780 ft.

WARD COUNTY

Bradford et al's No. 1 Carson, 990 ft. from NE and SE Sec. 26, Blk. 5, H.&T.C. Sur. ... Fishing 2,147 ft.; spraying 10 bbls. oil per day from 2,142 ft.
Bradford & Abell's No. 2 Boogher, 1,160 ft. from NW and 900 ft. from SW, Sec. 11, Blk. 5, H.&T.C. Sur. ... Rigging up.
Bradford's No. 1 York, 330 ft. from NE and SE of Sec. 10, Blk. 34, H.&T.C. Sur. ... Location.
Beckley et al's No. 1 Johnson, 4,140 ft. from NE and 990 ft. from SE Sec. 8, Blk. 32, H.&T.C. Sur. ... Drlg. 2,215 ft.; show gas 2,180 ft.; increase 2,197 ft.
Buster Black's No. 1 Hall & Roberts, 990 ft. from NE and 1,650 ft. from NW, Sec. 17, Blk. 32, H.&T.C. Sur. ... Drlg. 1,102 ft.
Central Oil & Gas Co.'s No. 1 Barrow, 330 ft. from NW and 1,263 ft. from SW, Sec. 55, J. W. Jackson Sur. ... Spudded and shut down.
Gibson & Johnson's No. 1 Johnson, 4,140 ft. from SE and 990 ft. from NE, Sec. 10, Blk. 32, H.&T.C. Sur. ... Drlg. 2,062 ft.
Gulf Prod. Co.'s No. 8 Hutchins, 2,310 ft. from S and 990 ft. from W of Sec. 3, Blk. F, G.M.M.B.&A. Sur. ... Location.
Hankinson et al's No. 1 Emery, 3,090 ft. from SE and 510 ft. from SW, Sec. 26, Blk. 5, H.&T.C. Sur. ... Top salt 840 ft.; pulling 10-in. casing; shut down 910 ft.
Magnolia Pet. Co.'s No. 1 Sealy (Atlantic), 2,130 ft. from S and 1,650 ft. from E, Sec. 45, Blk. F, G.M.M.B.&A. Sur. ... Top salt 2,345 ft.; drlg. 3,178 ft.
Pat Moran's No. 1 Sweatt, 1,470 ft. from SW and 150 ft. from NW Sec. 12, Blk. 5, H.&T.C. Sur. ... Location.
R. F. Owens' No. 1 Johnson, 100 ft. from NE and 1,100 ft. from SE of Sec. 8, Blk. 33, H.&T.C. Sur. ... Fishing 4,915 ft.
Peck et al's No. 1 Merrett, 3,166 ft. from NE and 2,648 ft. from SE, Sec. 11, Blk. 5, H.&T.C. Sur. ... Show gas 2,050 ft.; shut down 2,210 ft.; flowing 25 bbls. day.
Rector Oil Co.'s No. 1 Smith, 1,320 ft. from N and E, Sec. 22, Blk. A, G.M.M.B.&A. Sur. ... Drlg. 146 ft.
Shipley et al's No. 5 Hayzlett, 2,490 ft. from SE and 1,980 ft. from SW, Sec. 17, Blk. 5, H.&T.C. Sur. ... Shut down 2,520 ft.; 1,500 ft. oil in hole; waiting on tubing.
Simms Oil Co.'s No. 1 Himmel, 330 ft. from NE and 2,310 ft. from SE, Sec. 30, Blk. B-29, P.S.L. Sur. ... Top salt 965 ft.; shut down 2,431 ft.
Sturm's No. 1 Jones, 330 ft. from SW and SE of Sec. 25, Blk. B-29, P.S.L. Sur. ... Elev. 2,519 ft.; drlg. 2,362 ft.
Shipley et al's No. 1 Monroe, 330 ft. SE SW, Sec. 3, Blk. 1 ... Drlg. by tools 4,355 ft.

WINKLER COUNTY

White et al's No. 1 Owenby, 305 ft. from NE and 1,185 ft. from SE, Sec. 7, Blk. 32, H.&T.C. Sur. ... Drlg. 2,125 ft.
Liner Drlg. Co.'s No. 1 Campbell, 350 ft. from N and E cor., Sec. 2, Blk. B-5 ... Shut down 4,640 ft.

WILDCAT OPERATIONS IN TEXAS PANHANDLE

(Continued from Page 46)

Sanders et al's No. 1 Wright, 330 ft. S, 114 ft. E, Sec. 12, Blk. 3, I.&G.N. Sur. ... T.D. 2,811 ft; swbd. 204 bbls. first 24 hrs. and 191 bbls. second 24 hrs.
Steckoll & Reiger's No. 1 Davidson, 660 ft. N and W, Sec. 64, Blk. B-2, H.&G.N. Sur. ... Drlg. 1,525 ft.
Steckoll & Reiger's No. 1 Short, 330 ft. S and W, Sec. 17, B. E. Chaney Sur. ... Spudded and S.D.
Sullivan & Ochiltree's No. 1-A Morse, 330 ft. S and W, N½ NE, Sec. 15, Blk. A-9, H.&G.N. Sur. ... S.D. 2,636 ft.
Warner Oil Co.'s No. 1 Morse, 330 ft. S and W, N½ NW, Sec. 68, Blk. 25, H.&G.N. Sur. ... Cellar.

HUTCHINSON COUNTY

Danciger O. & R. Co.'s No. 1 Johnson, 330 ft. N and W, SE, Sec. 34, Blk. Y, A.&B. Sur. ... Rigging up.
Deal O. & G. Co.'s No. 2 Sanford, 330 ft. N and E of N 80 ac., S 160 ac., Sec. 81, Blk. 46, H.&T.C. Sur. ... S.D. 450 ft.
Huber Prod. Co.'s No. 1 Johnson Bros. (Premier), 330 ft. N and E of W 40 ac., N 80 ac., NW, Sec. 3, Blk. Y, A.&B. Sur. ... Big gas 2,330 ft. and 2,395 ft; drlg. 2,810 ft.
Huber Pet. Co.'s No. 1 McIlroy, 330 ft. S, 330 ft. W, Sec. 28, Blk. Y, A.&B. Sur. ... T.D. 3,205 ft; to plug back for gas.
Liner et al's No. 1 Johnson Bros., 990 ft. S, 330 ft. E, W½ SE, Sec. 29, Blk. Y, A.&B. Sur. ... Spudded and S.D.
Stanolind O. & G. Co.'s No. 2-A Pitcher, 990 ft. S, 330 ft. W, SE, Sec. 19, Blk. M-21, T.C.R.R. Sur. ... Plugged back 3,135 ft; swabs 20 bbls. per hr.; T.D. 3,150 ft.
Harry Steckel's No. 4 Whittenburg, 990 ft. N, 330 ft. E, NE, Sec. 89, Blk. Z, L.C.&S.F. Sur. ... S.D. 3,043 ft; shot with 90 qts. 3,005-43 ft; 1,200 ft. oil in hole.
Skelly Oil Co.'s No. 1 Johnson Bros., 660 ft. S and W, SE, Sec. 30, Blk. Y, A.&B. Sur. ... S.D. 3,115 ft.
Timms-Deatch's No. 4 Moore, 330 ft. N and W, Sec. 124, Blk. 4, I.&G.N. Sur. ... Rig.

LIPSCOMB COUNTY

Okla. Public Service Co.'s No. 1 C. W. Jones, NE SW, Sec. 100, H.&T.C. Sur. ... T.D. 5,003 ft.

LUBBOCK COUNTY

Center Oil Co.'s No. 1 Bowles Ranch ... Small S.O. 1,132-40 ft; S.D. 4,-167 ft.

MOORE COUNTY

Cloud & Dana's No. 1 Jones, 330 ft. N and E, SW, Sec. 169, Blk. 3-T, T.&N.O. Sur. ... T.D. 3,230 ft; estimated 74,000,-000 ft. gas.
Dana O. & G. Co.'s No. 1 R. Utey, 330 ft. S and W, NE, Sec. 135, Blk. 3, T.&N.O. Sur. ... T.D. 3,526 ft; making 5 bbls. wtr. and 1 bbl. b.s. per day.
Interstate's No. 1 Nield, C NE, Sec. 18, Blk. 44, H.&T. C. Sur. ... Location.
Magnolia Pet. Co.'s No. 1 Jones, 330 ft. N, 330 ft. E, Sec. 170, Blk. 3-T, T.&N.O. Sur. ... S.D. 100 ft.
Sunray Oil Co.'s No. 1 Rupert, 660 ft. N, 330 ft. E, NW, Sec. 191, Blk. 3-T, T.&N.O. Sur. ... Cellar.
Plains Holding Co.'s No. 2 Bivins, 1,115 ft. S, 627 ft. E, Sec. 93, Blk. 46, H.&T.C. Sur. ... 3,000,000 ft. gas 2,135 ft; T.D. 2,-550 ft; making 46,500,000 ft. gas.
Sunray Oil Co.'s No. 2 Jones, 330 ft. N and W, W½ SW, Sec. 164, Blk. 3-T, T.&N.O. Sur. ... Rig on ground.
The Texas Co.'s No. 1 Jester, C SW, Sec. 14, Blk. 6-T, T.&N.O. Sur. ... Gas 2,296-2,300 ft; S.D. 2,860 ft; 10,000,000 ft. gas.
Texas Interstate P. L. Co.'s No. 1-26 Thompson, C N½, NE, Sec. 26, Blk. 44, H.&T.C. Sur. ... Location.
Texas Interstate P. L. Co.'s No. 1-33 Sneed, C SW, Sec. 33, Blk. 6-T, T.&N.O. Sur. ... Location.
Texas Interstate P. L. Co.'s No. 1-37 Sneed, C NW, Sec. 37, Blk. 6-T, T.&N.O. Sur. ... Location.
Texas Interstate P. L. Co.'s No. 2-55, C SE, Sec. 55, Blk. 6-T, T.&N.O. Sur. ... Location.

MOTLEY COUNTY

Matador Oil Corp.'s No. 1 Owens, C NE, Sec. 10, Blk. G, B.&B. Sur. ... S.D. 530 ft.

OLDHAM COUNTY

Amalgamated German-American Oil Corp.'s No. 1 Norton, 330 ft. S and E, Sec. 12, T.&N.O. Sur. ... S.D. 400 ft.
Chambers et al's No. 1 Herring, CNL, Sec. 20, Blk. 8, G.C.&S.F. Sur. ... S.D. 800 ft.

ROBERTS COUNTY

Chicken Creek Oil Co.'s No. 1 Ledrick, 330 ft. N and W, Sec. 55, Blk. C, G.&M. Sur. ... Driving 20-in. csg. 25 ft.
Travis et al's No. 1 Cunningham, 330 ft. S and W, Sec. 74, Blk. M-2, H.&G.N. Sur. ... Drlg. 2,475 ft.

WHEELER COUNTY

Clarity et al's No. 1 Porter, NW cor. SE, Sec. 2, Blk. A-9, H.&G.N. Sur. ... Rig.
Vollmert's No. 1 Porter, 330 ft. S and E, NE, Sec. 15, Blk. 27, H.&G.N. Sur. ... Rigged up and S.D.

EAST CENTRAL TEXAS WILDCATS

(Continued from Page 45)

D. S. Hood's No. 1 J. J. Baiser, 185 ft. from S and 580 ft. W of Baiser 40-ac. tract in SE cor. T. B. Laddin Sur. ..... Drlg. 1,560 ft.

Worthington and Stedman's No. 1 W. H. Dejehett, 150 ft. from S and 776 ft. from W of 52-ac. tract, E. Chick Sur. ..... Shut down 1,927 ft.

ELLIS COUNTY

E. M. Roger's No. 1 John Lee Winn, 1,650 ft. from E and 510 ft. from S of Orland ..... Shut down 1,360 ft.; drill stem in hole.

FRANKLIN COUNTY

George L. Pace and L. B. Pruitt's No. 1 C. E. Cowan, 150 ft. out of NE cor. of 92-ac. tract and survey, Lipscomb Sur. ..... Derrick.

FREESTONE COUNTY

Raley and Clark's No. 1 McLancaster (Lampier), 150 ft. from E of W line and center of N and S line, B. Avant Sur. ..... Moving in rig.

E. L. Smith's No. 1 Emily Jackson, center of N 150-ac. of 300-ac. Emily Jackson tract ..... Drlg. 2,700 ft.

GREGG COUNTY

O. O. Alford et al's No. 1 L. M. Colburn, 208 ft. from N and 392 ft. from E of 39.7-ac. tract, Henry Hobson Sur. ..... Rig up.

Arkansas Fuel Oil Co.'s No. 1 Allison et al, 300 ft. from N and 250 ft. from W of tract and survey, William Robinson Sur. ..... Drlg. 2,710 ft.

Arkansas Fuel Oil Co.'s No. 1 J. C. and R. S. McKinley, 250 ft. from N and 176 ft. from E of 160-ac. tract and 87ac. lease, G. W. Hooper Sur. ..... Set 6⅝-in. csg. 3,555 ft.

Arkansas Fuel Oil Co.'s No. 2 P. D. Harrison, 282 ft. S and 143 ft. E of SE cor. of Tenery 40-ac. tract, William Robinson Sur. ..... Derrick pattern.

Arkansas Fuel Oil Co.'s No. 1 Vonie Calvin, 300 ft. from S and 300 ft. from W of 61-ac. lease and 119-ac. tract, Henry Hathaway Sur. ..... Run liner and washing in.

P. F. Ash et al's No. 1 A. H. Tubbs, 1,550 ft. from S and 4,120 ft. from E of survey, Dolores Sanches Sur. ..... Derrick.

Badgett and Ward's No. 1 Sample, 655 ft. S and 185 ft. W of SW cor. of A. Z. Jeffrey 29.5 acres, W. P. Chisum Sur. ..... Shut down 160 ft.

M. T. Beeler's No. 1 Finley and Thomas, 150 ft. from N and 150 ft. from W of 10-ac. lease, C. H. Alexander Sur. ..... Derrick.

Branson et al's No. 1 J. J. Fuller, 1,050 ft. from N and 170 ft. from W of survey, M. Alexander Sur. .. Derrick.

C. A. Bryan's No. 1 C. Vernon, 1,240 ft. from E and 151 ft. N of SW cor. of C. Vernon 58.75-ac. tract, W. W. Avery Sur. ..... Derrick.

Bell & Graddy's No. 1 M. George (or Daniels), 225 ft. S and 650 ft. W of 26-ac. tract, Mary Van Winkle Sur. ..... Drlg. 2,462 ft.

B. L. Brookin's No. 1 J. M. Tuttle, 150 ft. from N and 205 ft. from E of 12½-ac. lease, William H. Castleberry Sur. ..... Rig up.

Callahan, Thompson et al's No. 1 Fenn, 463 ft. from N and 150 ft. from E, 778 ft. from S of 44.5-ac. tract, David Ferguson Sur. ..... Drlg. 1,900 ft.

Campbell et al's No. 1 G. M. Collins, 160 ft. from E and 160 ft. from S of 84-ac. tract, G. W. Hooper Sur. ..... Sand 3,653-77 ft.; run tubing.

Cherokee-Chief Oil Co.'s No. 1 Todd, 230 ft. from N and 450 ft. from E of survey, Martha Dillard Sur. ..... Drlg. 385 ft.

Columbia Oil & Gas Co.'s No. 1-A Harley, 650 ft. E and 300 ft. S of SE cor. of Laura Walker 45-ac. tract, William Robinson Sur. ..... Derrick.

Cranfill & Reynolds' No. 1 Clayton heirs, 330 ft. from W of 20-ac. lease, L. B. Outlaw Sur. ..... Preparing to drill plug; T. D. 3,517 ft.

Cranfill & Reynolds' No. 1 A. D. Porter, 330 ft. from E and 330 ft. from S of 100-ac. tract, G. W. Hooper Sur. ..... Drlg. 2,500 ft.

Cranfill & Reynolds' No. 1 Mellie Fenn, 210 ft. from E and 500 ft. from S of 28-ac. tract, Haden Edwards Sur. ..... Rig up.

Tom David et al's No. 1 W. S. Pryor, 200 ft. from S and 200 ft. from W of 152-ac. tract, 2,600 ft. from E and 3,350 ft. from N of survey, Hamilton McNutt Sur. ..... Derrick.

Davis and Russell's No. 1 M. E. Anderson, 150 ft. from E and 75 ft. from S of 3-ac. lease in Kilgore Townsite, Mary Van Winkle Sur. ..... Shut down 3,553 ft.

Doss and Jones' No. 1 Ella Hegler, 400 ft. from N and 500 ft. from W of survey, J. S. Carrithers Sur. ..... Drlg. 2,715 ft.; top Pecan Gap 2,570 ft.

Charles Davidson et al's No. 1 Paul Jones, 7,000 ft. from most southerly N line and 3,600 ft. from W, W. P. Chisum Sur. ..... Drlg. 2,550 ft.

Daisy Oil Co.'s No. 1 Mrs. H. B. Ware, 1,000 varas from N and 350 ft. from W of survey, Avery B. Johnson Sur. ..... Drlg. 3,250 ft.

Sultan & Daniels et al's No. 1 B. Duncan, 420 ft. from N and 514 ft. from E of 28-ac. tract, G. F. Penn Sur. ..... Drlg. 3,110 ft.

Harry Elliott et al's No. 1 Woodley Jones, 2,125 ft. from N line and 2,720 ft. from E line of William H. Castleberry Sur. ..... Drlg. 3,215 ft.

Harry Elliott's No. 1 McNeely, 150 ft. from N and 150 ft. from E of 7.75-ac. tract, W. P. Chisum Sur. .... Drlg. 3,650 ft.

Eastland Oil & Gas Co.'s No. 1 B. B. Sparks, 150 ft. from N and 150 ft. from W of E 50 acres of 100-ac. tract, Harvey R. Kirk Sur. ..... Derrick.

Empire Oil & Refining Co.'s No. 1 Otto Lockhart, 150 ft. from E and 150 ft. from S of 75-ac. lease, P. W. Warranor Sur. ..... Rig up.

Gulf Production Co.'s No. 1 W. T. Goyne, 330 ft. from E and 330 ft. from S of lease, J. T. McDaniels Sur. ..... Derrick.

Gulf Production Co.'s No. 1 M. O. Shepherd, 728 ft. from N and 330 ft. from W of 38-ac. lease, George M. Rains Sur. ..... Top Pecan Gap 2,480 ft.; base Pecan Gap 2,915 ft.; top sand 3,545 ft.; T. D. 3,554 ft.

Greer's No. 1 L. M. Coburn, 150 ft. from E and 150 ft. from S of 45-ac. lease, 5,700 ft. from E and 850 ft. from N of survey, Henry Hathaway Sur. ..... Derrick.

Harper Petroleum Corp.'s No. 1 Woodley Jones, 2,000 ft. from N line and 3,900 ft. from E line of William H. Castleberry Sur. ..... Derrick.

O. L. Heckman's No. 1 C. H. Moore, 450 ft. W and 150 ft. N of NE cor. of E. M. Woods 39.3-ac. tract, Martha Dillard Sur. ..... Set 6⅝-in. csg.; T. D. 3,566 ft.

Howard and Russell's No. 1 Stone, 150 ft. from N and 150 ft. from E of 100-ac. tract, Bailey Anderson Sur. ..... Derrick.

Heep Oil Co.'s No. 1 S. B. Hall, 150 ft. from E and 150 ft. from S of lease and survey, David Dainwood Sur. ..... Drlg. 2,430 ft.

Humble Oil & Refining Co.'s No. 2 D. C. Johnston, 230 ft. from N and 450 ft. from W of John R. Crosby Sur. ..... Derrick.

Humble Oil & Refining Co.'s No. 1 A. L. Hughes, 108 ft. from N and 126 ft. from W of most northern NW cor. lease and tract, George Hampton Sur. .... Derrick.

Humble Oil & Ref. Co.'s No. 1 A. Carter, 780 ft. from S and 150 ft. from W of 92-ac. tract, David Ferguson Sur. ..... Washing in.

Humble Oil & Ref. Co.'s No. 1 H. M. Lawrence, 540 ft. from N and 219 ft. from W of 100-ac. tract, David Ferguson Sur. ..... Moving in material.

Hurburt and Brown's No. 1 L. L. Mackey, 990 ft. from E and 990 ft. from S of 269-ac. tract, 1,000 ft. from W and 990 ft. from S of survey, G. Y. Chambers Sur. ..... Will probably skid rig.

Iowa-Payne's No. 1 W. B. Walker, 375 ft. from S and 550 ft. from W of survey, E. R. Grisham Sur. ..... Set surface csg.

W. A. Jones' No. 1 G. Davis, 4,575 ft. from most easterly E line and 850 ft. from most northerly S line of lease, W. P. Chisum Sur. ..... Derrick.

K. B. Oil Co.'s No. 1 Dickson, 150 ft. from S and 150 ft. from W of 5-ac. lease, Mary Van Winkle Sur. ..... Derrick.

H. P. Key's No. 1 King, 150 ft. out of SE cor. of 48-ac. tract, W. P. Chisum Sur. ..... Drlg. 3,540 ft.

Kimsey-Trimble's No. 1 Griffith Davis, 922 ft. E of N line of Griffith Davis 119.5-ac. tract from NW cor. of same and 145 ft. S at right angles, W. P. Chisum Sur. ..... Drlg. 2,700 ft.

Kingwood Oil Co.'s No. 1 Godfrey, 1,900 ft. from W line and 6,500 ft. from N line of survey, Mary Van Winkle Sur. ..... Spudding.

Lion Oil & Refining Co.'s No. 1 C. D. Evans, 254 ft. from N and 254 ft. from S, 250 ft. from W of 16-ac. lease, Pleasant McAnally Sur. ..... Location.

Lacey et al's No. 1 T. D. Anderson et al, 150 ft. from S and 150 ft. from W of 13-ac. tract, G. W. Hooper Sur. ..... Sand 3,631-35 ft.; T. D.; running csg.

J. K. Livingston Oil Co.'s No. 1 D. C. Johnson, 200 ft. from N and 150 ft. from E of survey, Martha Dillard Sur. ..... Derrick.

Magnolia Petroleum Co.'s No. 1 Clem Jones, 150 ft. from E and 150 ft. from S of 65-ac. tract, G. W. Hooper Sur. ..... Drlg. 3,590 ft.; top Pecan Gap 2,550 ft.; base Pecan Gap 2,985 ft.

Magnolia Petroleum Co.'s No. 1 Jessie King, 7,000 ft. from most southern N line and 3,300 ft. from W, W. P. Chisum Sur. ..... Drlg. 3,505 ft.

Magnolia Petroleum Co.'s No. 1 R. L. Salter, 150 ft. from S and 150 ft. from W of 25-ac. tract, H. Edwards Sur. ..... Location.

Magnolia Petroleum Co.'s No. 1 W. B. Goyne, 150 ft. from S and 150 ft. from W of 31.7-ac. tract, J. T. McDaniel Sur. ..... Derrick.

Meek and King's No. 1 Harmony Grove School, 370 ft. from S and 150 ft. from W of 3.7-ac. tract, Mowry Irwin Sur. ..... Drlg. 2,875 ft.

Mid-Kansas Oil & Gas Co.'s No. 2 Barton, 685 ft. S along W line and Hollingsworth survey, from NE cor. W. P. Chisum Sur., thence 150 ft. at right angles, S. P. Hollingsworth Sur. ..... Drlg. 2,229 ft.

Mid-Kansas Oil & Gas Co.'s No. 1 Durham, 150 ft. from N and 150 ft. from E, W. P. Chisum Sur. .... Set 6⅝-in. csg. 3,607 ft.

Mid-Kansas Oil & Gas Co.'s No. 1 Hughey, 150 ft. from N and 150 ft. from W of tract and survey, James Hillard Sur. ..... Coring 3,480 ft.

Mid-Kansas Oil & Gas Co.'s No. 1 J. E. Choice, 2,100 ft. S and 500 ft. E of most easterly NW cor. of survey, W. P. Chisum Sur. ..... Drlg. 1,820 ft.

Owens et al's No. 1 C. E. Davis, 200 ft. from N and 340 ft. from E of 37-ac. tract and 18.3-ac. lease, William H. Castleberry Sur. ..... Set 6⅝-in. csg. 3,533 ft.

Overlees et al's No. 1 Mollie Fenn, 108 ft. from N and 126 ft. from W of survey, George Hampton Sur. .... Derrick.

J. O. Ferrin's No. 1 W. A. Burknight, 2,035 ft. from E and 350 ft. from S of survey, H. Edwards Sur. ..... Derrick.

Petroleum Finance Corp.'s No. 1 Lacy, 300 ft. from E and 318 ft. from S of survey, Grisham Sur. ..... Building derrick.

Prairie Oil & Gas Co.'s No. 1 Elder, 800 ft. from N and 800 ft. from E lines of survey, William McCurry Sur. ..... Preparing to swab; T. D. 3,551 ft.

Roeser and Pendleton's No. 1 Arthur Christian, 105 ft. from S and 308 ft. from W of 31-ac. lease, H. Hathaway Sur. ..... Set 142 ft. 10-in. csg.

Ross et al's No. 1, located on Findley & Thomas 50-ac. tract, 150 ft. from S line of 6.66-ac. lease, C. H. Alexander Sur. ..... Derrick.

C. Rosenfield et al's No. 1 J. A. Knowles, 700 ft. from E, 1,250 ft. from N, William Lyles Sur. ..... Shut down 3,010 ft.

Sabine Oil & Gas Co.'s No. 1 Harris, 3,500 ft. E and 3,500 ft. N of NE cor. of S. Lewis Sur., Mary Van Winkle Sur. ..... Derrick.

Seigler and McCall's No. 1 Missie Young, 330 ft. from N and 330 ft. from W of tract and survey, Carl Rhodes Sur. ..... Rig up.

Selby Oil & Gas Co.'s No. 1 H. R. Snavely, 325 ft. from E and 250 ft. from S of survey, John R. Crosby Sur. ..... Set 6⅝-in. pipe 3,519 ft.

Shell Petroleum Corp.'s No. 1 G. W. Richey, 150 ft. from E and 150 ft. from S of 60-ac. tract, William Carlton Sur. ..... Top sand 3,543 ft.; T. D. 3,543 ft.

Shell Petroleum Corp.'s No. 2 J. A. Knowles, 150 ft. from E and 400 ft. from S of survey, Allen Norris Sur ..... Top sand 3,646 ft.; T. D. 3,658 ft.

Shell Petroleum Corp.'s No. 1 E. W. Willoughby, 3,725 ft. from W line and 5,400 ft. from S line of survey, Mary Van Winkle Sur. ..... Drlg. 2,790 ft.

Shubert Drlg. Co.'s No. 1 Smith, 1,400 ft. from N and 2,800 ft. from E of survey ..... Drlg. 2,495 ft.

Smith et al's No. 1 J. B. Doby, 982 ft. from E and 150 ft. from S of 170-ac. tract, William H. Castleberry Sur. ..... Drlg. 2,370 ft.

E. L. Smith's No. 1 Cole, 893 varas S along E line of Samuel Brooks Sur. from NE cor. of same, thence 107 varas E at right angles, J. Meador Sur. ..... Moving in.

Sinclair Oil & Gas Co.'s No. 1 M. T. Cole, 2,640 ft. from N and 2,742.2 ft. from W line of survey, Samuel Brooks Sur. ..... Fire shot out; shut in.

Smith Ref. Co.'s No. 1 J. A. Knowles, 150 ft. from S, 150 ft. from NW of 75-ac. tract, 5,200 ft. from W, 7,700 ft. from N, Mary Van Winkle Sur. ..... Derrick.

Sun Oil Co.'s No. 1 G. W. Tate, 250 ft. from N and 250 ft. from E of 64-ac. lease and tract, William H. Castleberry Sur. ..... Straightening hole.

Stanolind and Simms Oil Co.'s No. 1 J. J. Flewellen, 353 ft. from N and 950 ft. from E of 200-ac. lease and 987-ac. tract, Marshall Mann Sur. ..... Running csg.

C. S. Thomas et al's No. 1 C. B. Everett, 300 ft. from N and 200 ft. from E of 30.25-ac. tract, John Ruddle Sur. ..... Drlg. 2,339 ft.

The Texas Company's No. 1 W. Baxter, 150 ft. from E and 150 ft. from S of lease, Mary Scott Sur. .... Drlg. 2,500 ft.

The Texas Company's No. 1 M. T. Cole, 3,400 ft. N and 1,325 ft. E of NE cor. of Samuel Brooks Sur., in the E. L. Walker Sur. ..... Drlg. 2,570 ft.

The Texas Company's No. 1 J. B. Bales, 330 ft. from S and 150 ft. from W of 30-ac. tract, William Carlton Sur. ..... Rig up.

Turner et al's No. 1 Raden Edwards, 150 ft. from N and 150 ft. from W of tract and lease, Hade Edwards Sur. ..... Set 10-in. csg. 76 ft.

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Valentine Oil Co.'s No. 1 Goyne-Hughey, 6,100 ft. from S and 6,800 ft. from W of survey, Mary Van Winkle Sur. ..... Derrick.

Walker and Harrison's No. 1 E. L. Walker, 1,025 ft. from N and 550 ft. from W of survey, Martha Dillard Sur. ..... Set 6⅝-in. csg. 3,507 ft.

Wise and Jackson's No. 1 F. J. Glover, 350 ft. from N and 125 ft. from E line of survey, George Melton Sur. ..... Derrick.

R. M. Wages et al's No. 1 Finley and Thomas, 165 ft. from E and 150 ft. from S of 10-ac. lease, Charles H. Alexander Sur. ..... Drlg. 2,110 ft.

Wise and Jackson's No. 1 Rose Corbit, 250 ft. from E and 250 ft. from S of E 80 acres of 155-ac. tract, H. Edwards Sur. ..... Derrick.

Woodley Petroleum Co.'s No. 1 Dyers, 200 ft. from S and 200 ft. from W of 640-ac. lease, H. Hathaway Sur. ..... Derrick.

Yount Lee Oil Co.'s No. 1-B R. S. McKinley, 1,993 ft. from S and 2,440 ft. W of NE cor. of 212-ac. tract, William Robinson Sur. ..... T. D. 3,642 ft.

Yount Lee Oil Co.'s No. 1 Thrasher and Stuckey, 309 ft. from N line and 331 ft. from E line of 80-ac. lease, G. W. Hooper Sur. ..... Drlg. 2,342 ft.

Ziegler Oil Co.'s No. 1 L. D. Campbell, 540 ft. from N and 219 ft. from E of 72½-ac. tract, David Ferguson Sur. ..... Derrick.

HENDERSON COUNTY

Arcadia Refining Co.'s No. 1 J. M. Dean, 150 ft. from S and 150 ft. from W of 42.75-ac. tract, Simon Boone heirs Sur. ..... Drlg. 3,526 ft.

Westside Investment Co.'s No. 1 Thornhill, 450 varas from W and 400 varas from N line of survey, James Spivey heirs Sur. ..... Rig up.

HOPKINS COUNTY

Abera, Alsup and Bolling's No. 1 McKay, Blk. 45, Hayden Arnold Sur. in SW cor. ..... Rig up to deepen.

LAMAR COUNTY

K. O. Bundy et al's No. 1 La Gatle, 200 ft. from N and 500 ft. from E of La Gatle tract, John V. Cherry Sur. ..... Moving in rig.

Everett & Allen's No. 1 Guest, 350 ft. S and 2,046 ft. E of 100-ac. tract, L. Roberts Sur. ..... T. D. 2,700 ft.; cored sand 2,656-2,700 ft.

Puritan's No. 1 George Parr, 3,000 ft. from W of Frisco Railway and 1,000 ft. from E line of R. Russell Sur. ..... Ready to spud.

LIMESTONE COUNTY

George McCamey's No. 1 B. K. Arnett, center of Blk. 13 in Casson Townsite ..... Shut down 1,730 ft.

MORRIS COUNTY

Dumas et al's No. 1 Tom Ball, 1,046 ft. from E and 248 ft. from S of 71-ac. tract, A. S. Young heirs Sur. ..... Derrick.

NACOGDOCHES COUNTY

Benedum & Trees' No. 1 Conkwright, 150 ft. from N in center of E and W lines of A. H. Conkwright 100-ac. tract, J. A. Cherino Sur. ..... Coring 4,064 ft.

Bunte et al's No. 1 A. F. Boatman, 330 ft. from S and 150 ft. from W of 67-ac. tract, William A. Moore Sur. ..... Shut down 1,605 ft.

Burke et al's No. 1 F. R. Patterson, 2,614 varas from W and 315 varas from W line of Patterson 70-ac. tract, Joseph Las Santos Chay Sur. ..... Shut down 4,270 ft.

E. L. Chapman's No. 1 Tilliford Hunt, 1,350 varas from S line and 1,468 varas from W line of survey, Stephen Strode Sur. ..... Shut down 3,300 ft.

Foreman and Weller's No. 1 Norris, 60 ft. NW of E line and 420 ft. S of road in 73.5-ac. tract, Hosea Y. Barbo Sur. ..... Skidding rig.

Fuhram et al's No. 1 Robert Mattaner, NW cor. of 630-ac. tract, J. A. Cherino grant ..... Rig up.

Harwell and Scott's No. 1 R. I. Driver, 1,500 ft. from SE cor. of P. B. Ballard 125-ac. tract, 15 miles SE of Nacogdoches in Patricia De Torres Sur. ..... Coring 1,850 ft.

Joiner and Henson's No. 1 Andy Legg, 330 ft. from N and 330 ft. from W of tract, John Durst Sur. .... Drlg. below 3,100 ft.

Joiner et al's No. 1 Reeves, 450 ft. from S and 350 ft. from W of survey, T. G. Loyd Sur. ..... Shut down 2,590 ft.

J. C. McNeil et al's No. 1 Hayter estate, 1,000 ft. E of Lace Creek and 300 ft. S of Nacogdoches and Jacksonville Highway De Las Santos-Coy Sur. .... Drlg. 2,640 ft.

W. W. Wheeler's No. 1 I. D. Parmley, about 155 varas N of S line and about center of E line of survey, John Kirby Sur. ..... Drlg. 3,371 ft.

Sequia's No. 1 Vanover, 6,072 ft. from N and 6,636 ft. from E of Alford Oliver Sur., E. Boyd E 100-ac. tract ..... Location.

Upland Oil Co.'s No. 1 E. M. Cooper, 300 ft. from N line and 300 ft. from E line of tract, James Windsor Sur. ..... Drlg. 3,000 ft.

Adams and Williams' No. 1 Stephenson, 600 ft. from N line and 1,300 ft. from W line of farm, Henry Kaber Sur. ..... Spudding.

Big Indian Oil Co.'s No. 1 J. N. Stewart, center of 79-ac. tract in the Jose Ignacio Ybarbo Sur. ..... Location.

RAINS COUNTY

Berry and Hale's No. 1 Ownsby, 150 ft. N and 1,100 ft. from E of most easterly SE cor. of survey, Alexander Sur. ..... Shut down 2,046 ft.

RED RIVER COUNTY

J. R. Sarland's No. 1 Bryan, 1,200 ft. SW of NE cor. of Bryan 130 acres, P. Vaughn Sur. ..... Derrick up.

Harris & Joiner's No. 1 E. Howison, 225 ft. S, 185 ft. W of 79-ac. tract, William Humphreys Sur. ..... Shut down 2,216 ft.

Pearsons et al's No. 1 J. R. Dellahunty, 400 ft. from N of Isaac Moore Sur. and 200 ft. E of E line of Robert Glass Sur. ..... Shut down 560 ft.

KILGORE AREA—RUSK COUNTY

Burton Drlg. Co.'s No. 2 B. B. S. Florey, 350 ft. out of NE cor. of Burton Florey 50-ac. lease, Peter Holmes Sur. ..... Location.

Blackwell Oil & Gas Co.'s No. 1 Moore, 4,950 ft. from W and 4,450 ft. from N of survey ..... Drlg. 3,400 ft.

Calloway et al's No. 1 Harmon, 1,800 ft. from E and 6,525 ft. from N of survey, F. Cordova Sur. ..... Drlg. 3,658 ft.; top Pecan Gap 2,742 ft.; base Pacon Gap 3,148 ft.

E. L. Chapman's No. 1 Oren Russell, 500 ft. W and 150 ft. S of most easterly NE cor. of Russell 30-ac. tract, J. English Sur. ..... Drlg. 1,954 ft.

Cox and Hamon's No. 3 D. M. Peterson, 150 ft. from N and W lines of 40-ac. tract, Isaac Ruddle Sur. .... Moving in material.

Crider and Manly's No. 1 R. A. Motley, 600 ft. from S and 1,150 ft. from W of J. T. McDaniels Sur. .... Derrick.

East Texas Refining Co.'s No. 1 Clara Webb, 150 ft. from N and 150 ft. from E of 15-ac. tract, Thomas Grace Sur. ..... Drlg. 400 ft.

Harry Elliott's No. 1 Carroll, 175 ft. from N and 200 ft. from E of 7-ac. tract, W. R. Cook Sur. ..... Location.

Hisy Drlg. Co.'s No. 1 George Thompson, 150 ft. from N, 150 ft. from E of tract of 70 acres and 10-ac. lease, 400 ft. S, 500 ft. W, Henry Dobson Sur. ..... Set 6⅝-in. csg. 3,650 ft.

Gulf Production Co.'s No. 2 Jernigan, 330 ft. from E and 330 ft. from S of lease, W. W. Simms Sur. ..... Rig up.

Gulf Production Co.'s No. 1 Russell, 150 ft. from the N and W lines of the S. R. W. Smith Sur. ..... Top sand 3,548 ft.

Houston Production Co.'s No. 1 S. S. Laird, 200 ft. from N and 150 ft. from W of survey, J. McKim Sur. ..... Spudding.

Humble Oil & Refining Co.'s No. 1 First Guarantee Bank of Overton, 330 ft. from S and 330 ft. from W of 80-ac. tract and survey ..... Rig up.

Humble Oil & Refining Co.'s No. 1 DeGuerin, 450 ft. from N and 300 ft. from E of 121.8-ac. tract, T. J. Martin Sur. ..... Location.

Humble Oil & Refining Co.'s No. 1 Wilson, 1,950 ft. from E and 1,850 ft. from S of survey ..... Run tubing; sand 3,688-3,708 ft.

Kirby Petroleum Co.'s No. 1 Jeff Reddie, 150 ft. from N and 150 ft. from W of 97.5-ac. tract, Thomas Grace Sur. ..... Drlg. 3,200 ft.

Lewis & Selby Oil & Gas Co.'s No. 2 Peques, 150 ft. from S and 150 ft. from W of S 15-ac. tract, G. Cooper Sur. ..... Building derrick.

Lyle and Orr's No. 1 Powers, 2,200 ft. from N and 360 ft. from E of survey, J. Womack Sur. ..... Derrick.

C. H. Lyon's No. 1 Ladd, 177 ft. from N and 177 ft. from W of 2-ac. tract, Henry Hobson Sur. ..... Drlg. 3,380 ft.

Magnolia Petroleum Co.'s No. 1 Florey, 150 ft. from N and E lines of tract, Peter Holmes Sur. ..... T. D. 3,668 ft.; plugged back to 3,647 ft.

Ray Martin's No. 1 Russell, 190 ft. from N and 5,050 ft. from W of survey, T. J. Martin Sur. ..... Moving in.

Moser's No. 1 Buntyn, 554 ft. from N and 225 ft. from E of survey, the most northeasterly cor. of survey, J. C. Snow Sur. ..... Spudded; shut down.

Rector and Davis' No. 1 Brightwell, 2,300 ft. from S line and 225 ft. from W line of survey, Robert E. Winn Sur. ..... Top sand 3,664 ft.; T. D. 3,708 ft.

Sun Oil Co.'s No. 1 A. A. King, 225 ft. out of SE cor. of A. A. King 100-ac. tract, Peter Holmes Sur. ..... Location.

Stanolind Oil & Gas Co.'s No. 1 O'Quinn, 3,050 ft. from W and 1,900 ft. from S of survey, George Berry Sur. ..... Rig up.

Stroube and Black's No. 1 W. M. Jernigan, 150 ft. from S and 150 ft. from W of lease, J. C. Snow Sur. ..... Building derrick.

Stanolind Oil & Gas Co.'s No. 1 Beal, 300 ft. from the S and W lines of the lease, W. P. Chisum Sur. .... Derrick.

JOINER POOL—RUSK COUNTY

Alford et al's No. 1 W. L. Thrash, 1,103 ft. from N, 420 ft. from E of SE cor., B. Smith Sur. ..... Derrick.

Armstring and Pitt's No. 1 Cooper, 3,150 ft. from W and 166 ft. from N of survey ..... Top Pecan Gap 2,560 ft.; drlg. 2,620 ft.

Armstrong's No. 1 Alford, 151 ft. from S and 1,080 ft. from W of survey, T. J. Moore Sur. ..... Derrick.

Bass et al's No. 1 Alford, 1,760 ft. from E and 5,260 ft. from N of survey, F. Cordova Sur. ..... Top Pecan Gap 2,750 ft.; base Pecan Gap 3,160 ft; preparing to set csg.; T. D. 3,742 ft.

Big Indian Oil Co.'s No. 1 Deason, 360 ft. from E and 4,100 ft. from S of survey, M. J. Prue Sur. ..... Drlg. 2,696 ft.

Campbell Oil Co.'s No. 1 Compton, 600 ft. from N and W line of Simon Del Rio Sur., 1½ miles NW of Minden ..... Derrick.

Cochran and Smith's No. 1 J. P. Cansler, 150 ft. from S and 1,025 ft. from W of 38.5-ac. tract, E. Collard Sur. ..... Set 6-in. csg. 3,661 ft.

Consolidated Oil Co.'s No. 3 Jobe, 4,500 ft. from W and 3,160 ft. from N of survey, Juan Ximenes Sur. ..... T. D. 3,685 ft.

Consolidated Oil Co.'s No. 4 Jobe, 4,025 ft. from W and 3,160 ft. from N of survey, Juan Ximenes Sur. ..... T. D. 3,677 ft.

E. L. Chapman's No. 1 A. P. Finney, 150 ft. from W of E 20 acres of 102-ac. tract, Isaac G. Parker Sur. .. Shut down 3,606 ft. in sand.

F. L. Coogan's No. 1 Florence, 4,480 ft. from W and 4,050 ft. from S of survey, F. Cordova Sur. ..... Drlg. 2,350 ft.

Comb's No. 1 Fox, 3,150 ft. from S and 150 ft. from E of survey, D. Carmack Sur. ..... Derrick.

R. H. Deering & Son's No. 1 T. H. Goforth, 150 ft. from S and 150 ft. from W of 22-ac. lease and 62-ac. tract, J. Lindly Sur. ..... Fishing 3,154 ft.

Droppleman Development Co.'s No. 1 Cox, 334 ft. from N and 330 ft. from W of 20-ac. lease or survey, John Darley Sur. ..... Derrick.

Dan Dillon et al's No. 1 W. H. Frederick (Jake), 150 ft. from E, 150 ft. from S of 50-ac. tract, Juan Ximenes Sur. ..... Derrick.

Danciger's No. 1 Deason, 3,925 ft. from S and 650 ft. from W of survey, Juan Ximenes Sur. ..... Swabbed through tubing; dry.

East Texas Refining Co.'s No. 1 J. Bell, 1,250 ft. from E and 750 ft. from N of survey, S. P. Hollingsworth Sur. ..... Moving in.

East Texas Refining Co.'s No. 1 Grissom, 4,500 ft. from W and 5,630 ft. from S of survey, F. Cordora Sur. .. Drlg. 2,935 ft.

Elliott's No. 1 Alford, 445 ft. N and 194 ft. W of most westerly SW cor. of J. P. Maxwell 144-ac. tract, I. G. Parker Sur. ..... Drlg. 1,800 ft.

Elsy and Tauteaham's No. 1 Deason, 1,300 ft. from W and 3,700 ft. from S of survey, Juan Ximenes Sur. .. Shut down 2,310 ft.

Elsy Drlg. Co.'s No. 1 Frederick, 150 ft. from S and 602 ft. from W of Frederick 90-ac. tract, Juan Ximenes Sur. ..... Derrick.

Empire Oil & Refining Co.'s No. 1 Leverett, 150 ft. from S and 150 ft. from W of survey, J. C. Snow Sur. ..... Shut down 2,791 ft.; top Pecan Gap 2,685 ft.

Great Eastern Oil Co.'s No. 1 Mayfield-Alford, 250 ft. from S and 250 ft. from W of Alford tract, T. J. Moore Sur. ..... Fishing 2,985 ft.

Gulf Production Co.'s No. 1 Keeling, 1,550 ft. from E and 3,950 ft. from S of survey, F. Cordova Sur. .... Sand 3,752-60 ft.

Griffith's No. 1 J. F. Lowe, 500 varas E of W line and 200 varas S of N line of 268-ac. tract, William Williams Sur. ..... Fishing; T. D. 3,705 ft.

Humble Oil & Refining Co.'s No. 1 Mattie Wooster, 1,200 ft. from E and 384 ft. from S of survey, W. H. Bears Sur. ..... Drlg. 360 ft.

Humble Oil & Ref. Co.'s No. 1 Plowman, 163 ft. from S and 1,074 ft. E of NW cor. of M. L. Thompson 129.6-ac. tract, F. Cordova Sur. ..... Drlg. 3,369 ft.

Humble Oil & Refining Co.'s No. 1 Walker, 4,050 ft. from W line and 900 ft. from S of survey, F. Cordova Sur. ..... Top Pecan Gap 2,706 ft.; base Pecan Gap 3,078 ft.; T. D. 3,660 ft.

Humble Oil & Refining Co.'s No. 1 Jones Fuller, 330 ft. from N and 330 ft. from W of 115.66-ac. tract, J. Ellington Sur. ..... Building derrick.

Humble Oil & Refining Co.'s No. 1 W. A. Mullikin, 4,200 ft. from S and 6,700 ft. from E of survey, T. J. Martin Sur. ..... Location.

Humble Oil & Refining Co.'s No. 1 R. T. Cameron, 3,300 ft. from S and 6,700 ft. from E of survey ... Building derrick.

H. L. Hunt's No. 1 Smith-Wilson, 407 ft. from N and 425 ft. from W of lease, George Berry Sur. ..... Derrick.

Jackson-Wise and Sneden, 215 ft. from E and 175 ft. from S of 40-ac. lease, M. J. Prue Sur. ..... Rig up.

Albert Jones' No. 1 John Minnifee, 100 ft. from S and 1,000 ft. from W of survey on 70-ac. tract, T. J. Walling Sur. ..... Derrick.

C. C. Julian's No. 1 Motley, 740 ft. from N and 1,673 ft. from W of survey, J. T. McDaniels Sur. ..... Set csg.; T. D. 191 ft.

Kirby Petroleum Co.'s No. 1 Samp Stone, 4,100 ft. from W and 3,350 ft. from N of survey, M. J. Prue Sur. ..... T. D. 3,605 ft.; waiting on csg.

Kimbrough et al's No. 1 Weatherby, 300 ft. from N and 300 ft. from E, Robert Martin Sur. ..... Fishing 3,460 ft.

Lee and Young's No. 1 John Whelis, 150 ft. from N and 150 ft. from E of 15.3-ac. tract, F. Cordova Sur. ..... Drlg. 1,610 ft.

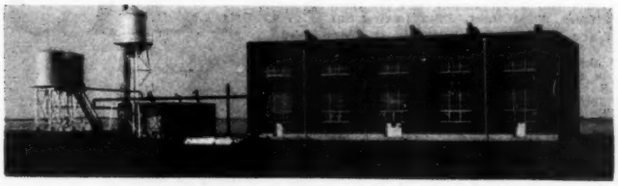
Interior of a Missouri pumping station serving a 12-inch line. The three pumps, each driven by a 600-hp. McIntosh & Seymour Engine, meet a demand of 70,000 bbls. per day at 700-lb. line pressure. Two of the pumping outfits handle this load, with the third in reserve as a spare. An exterior view of this station appears below.

The prevalence of McIntosh & Seymour Diesel installations in oil-pumping stations is merely the survival of the fittest

PIPE LINES became the accepted and popular means of oil transfer only after Diesel power solved the pumping problem.

In the earlier Diesel days, most stations were isolated, in dusty surroundings, many had inadequate or impure water supply, and capable operators were hard to get. All physical conditions were severe, but pipe line owners, realizing the inherent Diesel advantages over steam, and eager to get greater and faster deliveries, did what they could to encourage development of oil-burning internal-combustion prime movers.

Orders were placed for all promising types and makes and for more units than in all other American industries combined. Owners gave their installations excellent supervision and co-operated in every way in suggesting design improvement. Builders on the other hand, realized that oil pumping offered them a prize opportunity, and with equal earnestness, strained every facility to more than meet the requirements.



In this free-for-all competition, with equal opportunities for all and ample tests for proving, McIntosh & Seymour installations were in the field early, always made excellent records and consistently forged ahead to their present high standing.

Earlier McIntosh & Seymour models are still holding their own against much later comers. The more modern McIntosh & Seymour units are the best assurance you can buy for continuous heavy-load capacity at high economy with crude oil fuel of about every grade, for long useful life at minimum maintenance expense and with notable freedom from operating interruptions.

Let us figure with you on your pumping power needs.

McINTOSH & SEYMOUR CORPORATION, *Main Office and Works: Auburn, N. Y.*

Division of American Locomotive Company

New York, 30 Church St. | Kansas City, Mo., 1016 Baltimore Ave. | Jacksonville, Fla., 219 Humble Bldg. | San Francisco, Cal., 514 Matson Bldg. | Houston, Tex., 2408 Esperson Bldg.

McINTOSH & SEYMOUR DIESEL ENGINES

Leonard Petroleum Co.'s No. 1 Sanger Bros., 390 ft. from N and 350 ft. from W of survey, J. P. Meredith Sur. ..... Drlg. 3,333 ft.
Magnolia Petroleum Co.'s No. 1 Eaton, 5,700 ft. from E and 1,500 ft. from N of survey, F. Cordova Sur. .. Drlg. 1,268 ft.
Magnolia Petroleum Co.'s No. 2 Moore, 330 ft. S and 448 ft. E of NE cor. of J. Womack Sur., Jesse Ellington Sur. ..... Drlg. 3,158 ft.
Madden et al's No. 1 Mose Mayfield, 960 ft. from S and 160 ft. from W line of 154-ac. lease, Daniel Clark Sur ..... Testing 3,734 ft.
Mass and Tucker's No. 1 Matthews, 3,244 ft. from N, 4,356 ft. from E, Dalines Cartimas Sur. ..... Drlg. 3,176 ft.
McMillan's No. 1 Sam Stone, 1,700 ft. from N and 6,300 ft. from W of survey ..... Derrick.
G. B. Mitchell et al's No. 1 Ras Pool, 2,700 ft. from E and 4,275 ft. from N of survey, M. J. Prue Sur. .... Drlg. 3,714 ft.
Nat Saddler's No. 1 Ed Sparks, 350 ft. from E, 150 ft. from S of survey, L. C. Riggs Sur. ..... Drlg. 1,506 ft.
Pharis and Sample's No. 1 Deason, 1,558 ft. E and 155 ft. S of SE cor. of H. Brooks tract in M. J. Prue Sur. ..... Drlg. 3,615 ft.
Philmack's No. 1 Keeling, 330 ft. from S and 330 ft. from W of 10-ac. lease, F. Cordova Sur. ..... Drlg. 2,565 ft.
Phillips Petroleum Corp.'s No. 1 L. J. Pinkston, 590 ft. from N and 231 ft. W of lease, M. J. Prue Sur. ..... Drlg. 2,175 ft.
Phillips Petroleum Co.'s No. 1 Wilson, 142 ft. from E and 135 ft. from S of Phillips 51-ac. tract, M. J. Prue Sur. ..... Preparing to wash.
Rowe et al's No. 1 Maxwell, 855 ft. from E and 237 ft. from S of B. F. Maxwell 59-ac. tract, R. H. Pinney Sur. ..... Derrick.
Southern Crude Oil Purchasing Co.'s No. 1 C. Smith, 330 ft. from S line and 150 ft. from E line of lease, William Killen Sur. ..... Coring 3,744 ft.
Stokes et al's No. 1 Mrs. M. M. Talley, 4,100 ft. from W and 1,050 ft. from N of survey ..... Moving in rig.
Sun Oil Co.'s No. 1 Horace Schuler, 3,850 ft. from W and 6,110 ft. from N of survey, J. B. De Cadena Sur ..... Drlg. 2,840 ft.
Shell Petroleum Corp.'s No. 1 Able Holt, 150 ft. from N and 150 ft. from W of lease, Daniel Clark Sur. .. Coring 3,625 ft.; top sand 3,622 ft.
Sinclair Oil & Gas Co.'s No. 2 W. D. Kinney, 200 ft. from E and 200 ft. from S of lease, J. B. De Cadena Sur. ..... Drlg. 3,030 ft.
Sinclair Oil & Gas Co.'s No. 1 March, 330 ft. from E and 330 ft. from S of March 441-ac. tract, Leonard Williams Sur. ..... Recementing surface pipe.
Stanley and Winn's No. 1 Young, 150 ft. from E and 6,000 ft. from S of survey, M. J. Prue Sur. ..... Rig up.
Strube-Collins-Wheelock's No. 1 F. R. Russell, 425 ft. from E and 250 ft. from S of N 35 acres of 70-ac. Russell tract, T. J. Martin Sur. ..... Moving in material.
Suttle's No. 2 Holland, 156 ft. from N and 152 ft. from W of Holland 41.7-ac. tract, M. J. Prue Sur. ..... Shut down 1,750 ft.
Stanolind Oil & Gas Co.'s No. 1 M. E. King, 330 ft. from N and 330 ft. from W of lease, Meredith McCabe Sur. ..... Coring 3,664 ft.
The Texas Company's No. 1 Pinkston, 3,100 ft. from N and 150 ft. from E of survey, J. B. De Cadena Sur. ..... Rig up.
Tidal Oil Co.'s No. 1 Joel Shaw, 1,620 ft. from W and 1,590 ft. from S of survey, E. Collard Sur. ..... Drlg. 2,235 ft.
Tidal Oil Co.'s No. 2 Irion, 6,300 ft. from W and 6,500 ft. from N of survey, M. J. Prue Sur. ..... Drlg. 3,038 ft.; top Pecan Gap 2,720 ft.
Tidal Oil Co.'s No. 2 Thompson, 384 ft. from N and 330 ft. from W of tract, John Darley Sur. ..... Drlg. 2,835 ft.
Tunstill et al's No. 1 J. Henshaw, 180 ft. from N and 180 ft. from E of 40-ac. tract and lease, Henry B. Dance Sur. ..... Location.
West Texas Oil & Royalty Co.'s No. 1 King, 330 ft. from S and 330 ft. from W of survey and 129-ac. tract, John C. Morrison Sur. ..... Drlg. 3,438 ft.

SMITH COUNTY

Arkansas Drilling Co.'s No. 1 Wallace, 150 ft. from N and 150 ft. from E of 200-ac. tract, W. W. Avery Sur. ..... Waiting on csg.; T. D. 141 ft.
Ark.-La. Drilling Co.'s No. 1 L. A. Wallace, 150 ft. out of NE cor. of 200-ac. tract, W. W. Avery Sur. ... Waiting on csg.
Bailey Gaunce et al's No. 1 S. S. Cook, 150 ft. from S and 150 ft. from W of S. S. Cook 20-ac. tract in 159-ac. tract, Juan Vargus Sur. ..... Shut down 2,560 ft.
Bailey Caunce et al's No. 1 S. S. Cooke, 150 ft. from S and 150 ft. from W of S. S. Cooke 20-ac. tract in 159-ac. tract, Juan Vargus Sur. ..... Shut down 2,560 ft.
Big Indian Oil Co.'s No. 1 Mills, 1,045 ft. E along S line of C. Mills 67.5-ac. farm, SW cor. of same and 710 ft. N at right angles to S line of 67.7 acres, J. Jordan Sur. ..... Drlg. 3,085 ft.
Big Indian Oil Co.'s No. 1 Holland, 2,324 ft. from N and 1,446 ft. from E line of survey, Thomas Allen Sur. ..... Drlg. 3,770 ft.
J. H. Brogan, trustee's No. 1 T. O. Wright, 600 ft. from N and 300 ft. from E of survey, Juan Vargus Sur. ..... Location.
G. E. Bunte, trustee's No. 1 A. S. Jarvis, 150 ft. from S and 150 ft. from W of 267-ac. tract, Juan Vargus Sur. ..... Rig up.
Roy I. Carter's No. 1 T. O. Wright, 1,445 ft. from N and 182 ft. from E of survey, Juan Vargus Sur. .... Moving in rig.
Concord Oil Co.'s No. 1 Wolford, 147 ft. from S and 147 ft. from W of Wolford tract, center of 3-ac. lease, James Jordan Sur. ..... Drlg. 3,345 ft.
Cotton Belt Oil Co.'s No. 1 C. S. Jackson, 500 ft. from N and 500 ft. from W of 39.88-ac. tract, Henry Mickleborough Sur. ..... Derrick.
Deason Oil Co.'s No. 1 T. O. Wright, 1,440 ft. from N and 250 ft. from W of T. O. Wright 86-ac. tract, Juan Vargus Sur. ..... Location.
Deering & Son's No. 1 Wright, 1,815 ft. from N and 150 ft. from E of survey, Juan Vargus Sur. ..... Derrick.
Dumas' No. 1 Cooke, 1,558 ft. SE along center line of Highway No. 64 from point where S. S. Cooke 17.6-ac. tract W line intersects highway and 942 East Texas Refining Co.'s No. 1 Colored Methodist Church, James Jordan Sur. ..... Derrick.
ft. at right angles to road, James Jordan Sur. ... Rig up.
Hancock and McCarthey's No. 1 J. C. Cross, 200 ft. from E of road and 200 ft. N of S line of survey on a 13-ac. tract, Burbridge Sur. ..... Derrick.
Imperator Oil Co.'s No. 1 I. M. Green, 140 ft. from S and 165 ft. from E line of Green 86.5-ac. tract, NW of Overton and N and a little E of Big Indian No. 1 Holland ..... Set 10-in. csg. 180 ft.
Joiner et al's No. 1 W. W. Wright, 847.5 varas from E and 647 varas from S of NW Wright 226-ac. tract, Van Sickle Sur. ..... Chalk 3,780 ft.
McMillan's No. 1 Wright, 794 ft. from N and 171 ft. from W of T. C. Wright 86-ac. tract, Juan Vargus Sur. ..... Derrick.
Morrison's No. 1 I. Roy, 330 ft. N and E from SW cor. of 87-ac. tract in Henry Cools Sur. ..... Drlg. 1,345 ft.
M. M. Rowand et al's No. 1 Gibbons, 1,300 varas from W and 260 varas S of river (which is N line of survey), J. M. Garcia Sur. ..... Drlg. 1,400 ft.
Ruffin and Williams' No. 1 Hamp Florence, 700 ft. from N and 200 ft. from E of 193.5-ac. tract, Barnes Clark Sur. ..... Coring 3,965 ft.
Owen and Sloan's No. 1-B Starnes, 5,018 ft. from W and 3,030 ft. from N of Samuel Epps Sur. ..... Coring 3,849 ft.
Sinclair Oil & Gas Co.'s No. 1 Mayfield, 2,194 ft. from N and 3,625 ft. from W of 376-ac. Mayfield lease, James Jordan Sur. ..... Derrick.
Sinclair Oil & Gas Co.'s No. 1 Patterson, 300 ft. from E and 150 ft. from S of farm, Juan Vargus Sur..... Preparing to wash in; T. D. 3,670 ft.
E. L. Smith's No. 1 William Stone, 330 ft. from E and 150 ft. from S of survey, D. Campbell Sur. ..... Preparing to drill plug; T. D. 3,810 ft.
Sun Oil Co.'s No. 1 J. Henson, 600 ft. from E and 6,700 ft. from S of survey, Juan Vargus Sur. ..... Drlg. 3,598 ft.; top Pecan Gap 2,702 ft.; base 3,093 ft.
Sun Oil Co.'s No. 1 A. V. Rick, 205 ft. from N and 300 ft. from W of 99-ac. tract, Juan Vargus Sur. .... Drlg. plug.; T. D. 3,670 ft.
Sun Oil Co.'s No. 1 J. J. Denton, 250 ft. from the N and 288 ft. from E lines of 114.2-ac. tract in Juan Vargus Sur. ..... Shut down 3,695 ft.
Winona O. & G. Co.'s No. 1 Freeman, 150 ft. from S, W of 89-ac. tract in A. J. Legrone Sur., 4 miles SE of Winona ..... Shut down 3,681 ft.

TITUS COUNTY

H. V. Cook's No. 1 M. C. Rogers, center of SW of Moore Sur. ..... Moving in rig.

UPSHUR COUNTY

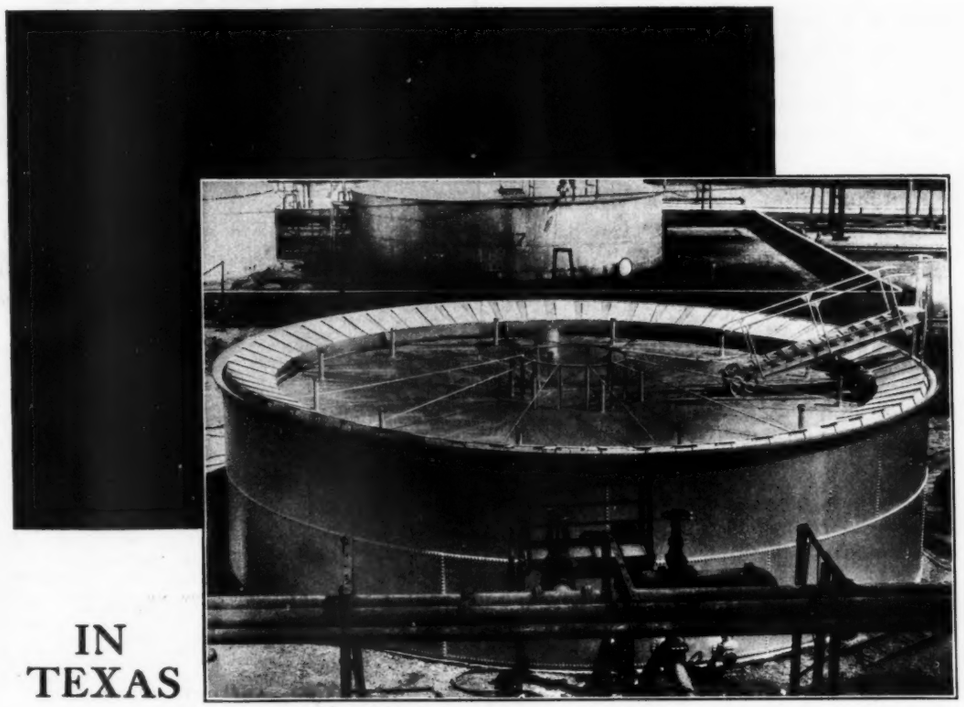
Arcadia Refining Co.'s No. 1 R. S. Johnson, 1,000 ft. from N and 1,000 ft. from E of survey, J. H. Mallory Sur. ..... Coring 3,220 ft.
Brennan and Wood's No. 1 Robertson, center of Robertson 41-ac. tract, Ira Stephenson Sur. ..... Shut down 3,661 ft.
Joe Burnham's No. 1 Lena Beck, 4,000 ft. from S and 1,200 ft. from W of survey, H. W. Augustine Sur. .. Drlg. 113 ft.
Cockrell et al's No. 1 C. A. Lee, 150 ft. from S and 150 ft. E of 26½-ac. tract, W. L. Palmer Sur. ..... Derrick.
Daniel and Hargrove's No. 1 Ann Callahan, 150 ft. from E and 150 ft. from S of 38-ac. tract, E. A. J. Evans Sur. ..... Derrick.
Decker et al's No. 1 T. A. Webb, 150 ft. from N and 150 ft. from W of 34.26-ac. tract and lease, G. H. Hooper Sur. ..... Rig up.
Dumas et al's No. 1 A. O. Phillips, 150 ft. from N and 150 ft. from E of W 25.3-ac. of 75-ac. tract, S. Harrell Sur. ..... Derrick.
Home Oil Co.'s No. 1 F. D. Futrell, 150 ft. out of SW cor. and 520 ft. from E and 400 ft. from S line of 7.6-ac. tract, A. Lumbrara Sur., south of Gilmar ..... Drlg. 1,000 ft.
Humble Oil & Refining Co.'s No. 1 J. K. Edwards, 325 ft. out of SE cor. of the W 200 acres of the 281-ac. tract, B. Ferguson Sur. ..... Drlg. 2,000 ft.
Humble Oil & Refining Co.'s No. 1 A. O. Phillips, 267 ft. from S and 225 ft. from W of 51-ac. lease, S. Harrell Sur. ..... Location.
Heydrick and Camp's No. 1 J. W. Free, 330 ft. from N and 330 ft. from W of 28-ac. tract, G. W. Hooper Sur. ..... Drlg. 2,810 ft.
Magnolia Petroleum Co.'s No. 1 Howard Hampton, 150 ft. from N and 150 ft. from E of most north NE cor. of 69-ac. lease and tract, David Ferguson Sur. ..... Drlg. 1,210 ft.
Magnolia Petroleum Co.'s No. 2 Howard Hampton, 215 ft. from NW and 215 ft. from SW of 169-ac. lease, David Ferguson Sur. ..... Derrick.
McMahon and McCollough's No. 1 E. H. Hamilton, 200 ft. from E and 150 ft. from S of 88-ac. tract, M. Chandler Sur. ..... Derrick.
McPhail and Smith's No. 1 Kay, 660 ft. from S and 660 ft. from W line of J. Elliott Sur., 1¼ miles S of Big Sandy ..... Drlg. 2,900 ft.
Mudge Oil Co.'s No. 1 J. W. Free, 150 ft. from E and 150 ft. from S of tract, David Ferguson Sur. ..... Derrick.
Joyce Richardson's No. 1 O'Byrne, 150 ft. out of SE cor. of 76-ac. tract and in William Bratton Sur. .... Location.
Sorrells & Duffey's No. 1 J. W. Wooden, 200 ft. from E and 200 ft. S of survey, Isham Williams Sur. .... Shut down 100 ft.
A. A. Trammell's No. 1 O. M. Victory, 150 ft. from E and 150 ft. from S of SW 100 acres of survey, E. A. J. Evans Sur. ..... Drlg. 1,750 ft.
Union Drilling Co. et al's No. 1 W. M. Phillips, 300 ft. from E and 300 ft. from S of 67½-ac. tract and lease, H. Edwards Sur. ..... Location.
R. M. Weaver, Jr. et al's No. 1 L. J. Everett, 330 ft. from E and 330 ft. from S of 173-ac. tract, W. Goodwin Sur. ..... Drlg. 700 ft.

VAN ZANDT COUNTY

Barton et al's No. 1 C. L. Hubbard, 600 ft. out of NE cor. of Hubbard 225-ac. tract, 3½ miles S of Canton, M. J. Cadena Sur. ..... Spudded and shut down.
Hart Petroleum Corp.'s No. 1 M. L. Cox, 1,785 ft. N of S line and 524 ft. E of W line of Cox 300-ac. tract in Nugent Headright Sur. ..... Shut down 1,142 ft.
H. Helms et al's No. 1 Bogue, 647 ft. W and 155 ft. S of SE cor. of J. M. Brown 70-ac. in Marshall University Sur., SE of Van ..... Shut down 3,098 ft.
Joiner et al's No. 1 J. S. Meeks, 330 ft. out of the NE cor. of the 330-ac. tract, A. Ducher Sur. ..... Drlg. 2,058 ft.; top Pecan Gap 1,380 ft.
Humble Oil & Ref. Co.'s No. 1 L. A. Dowdle, 1,027 ft. N of S line and 150 ft. E of W line, William Daniel Sur ..... Temp. abnd. 2,987 ft.
Humble Oil & Ref. Co.'s No. 1 York, 150 ft. from E and 175 ft. from S, William Daniel Sur. ..... Drlg. 2,050 ft.
Kelly Oil & Gas Co.'s No. 1 Lemsford, center of Lemsford tract, John Conner Sur. ..... Shut down 2,300 ft.
Neil McMehory's No. 1 R. V. Murphy, 150 ft. from N and 150 ft. W of survey, H. Bailey Sur. ..... Shut down 2,450 ft.
W. P. Palmer et al's No. 2 W. P. Forster, 600 ft. from N and 450 ft. from E of SW cor. of Forster 151-ac. tract in the F. Montgomery Sur. ..... Drlg. 2,800 ft.
W. A. Phillips et al's No. 1 Morris, 1,050 ft. S of N line and 350 ft. W of E line of center west of Morris 160-ac. tract in the C. L. Morris Headright Sur. .... Waiting on drill stem.
Pure Oil Co.'s No. 2 Shivers, 200 ft. S of N line and 200 ft. E of W line of lease, John Walling Sur. .... Running derrick.
Pure Oil Co.'s No. 7, 370 ft. N of S line and 200 ft. W of E line of 109-ac. tract, John Walling Sur. .... Cement setting 2,942 ft.
Pure Oil Co.'s No. 3 A. D. Clark, 70 ft. N of S line and 120 ft. E of W line of lease, J. Walling Sur. ..... Location.
Pure Oil Co.'s No. 3 W. T. Jarman, 325 ft. S of N line and 250 ft. E of W line of lease in Nacogdoches County School Land ..... Cement setting 2,872 ft.
Pure Oil Co.'s No. 3 L. A. Smith, 707 ft. S of N line and 250 ft. W of E line of lease in John Walling Sur. ..... Running liner 2,938 ft.
Van Oil Association's No. 1 Tankersley, 200 ft. from E and 1,000 ft. from S of farm, L. Landers Sur. .... Shut down 1,028 ft.

WOOD COUNTY

Loche & Clark's No. 1 A. C. Pick, 165 ft. S of NE cor. G. C. Reeves 25-ac. tract, Daniel Fuller Sur. .... Shut down 2,008 ft.
Deep Rock Oil Co.'s No. 1 Maud Smith, center of Maud Smith 3 40-ac. tract, L. Johnson Sur. ..... Top Pecan Gap 2,785 ft.; base Pecan Gap 2,985 ft.
Main Holding Co. and Thelma Wells' No. 1 Stewart, 1,938 ft. from NE and 2,898 ft. from E line of survey, E. Rehorse Sur. ..... Moving in rig.
Vitek Oil Co.'s No. 1 Rosa Bogel, 350 ft. from N and 500 ft. from W of survey, Sarah English Sur. ..... Spudded; shut down.
M. O. Walmar Oil Co.'s No. 1 J. A. Ivey, center of 57-ac. tract, 2 miles NE of Mineola, A. Hamilton Sur. .. Location.



IN TEXAS

EFFICIENCY Counts

—Inefficient Decks are Hazardous—

Petroleum in its crude state or even in its lighter fractions such as gasoline or kerosene, is not inflammable while it is entirely in its liquid form.—But when the volatile hydrocarbons of the crude mix with the oxygen in the air, fire hazard is at once apparent.—Hundreds of thousands of dollars are consumed every year by oil fires, and hundreds of thousands more vanish with the escaping vapors of evaporation.—Expensive, but preventable losses.

—Columbian Floating Decks are Safe—

It is an established fact that evaporation can occur only from the surface of the fluid exposed to the air.—The surface of the fluid stored in a tank equipped with a COLUMBIAN Floating Deck is unexposed to air.—Where there is no air space, there cannot be any vaporization; where there is no vaporization, there is no evaporation.—Hence no fire hazard.—That's why the Columbian Floating Deck shown above replaced an inefficient, competitive deck.

Inquiries are invited on: Oil and Water Storage Tanks, Oil Settling Tanks, Lubs Oil and Pressure Tanks, Protective Casing, Metal Buildings and Warehouses, Agitators and Condenser Boxes, Meter Houses and Drainage Troughs. Also on Reinforcing Welding Bars, Black Plates and Shapes and Specification Work of all Kinds.

Columbian Floating Decks are built to fit any size or type of tank.—Complete plans, specifications and prices gladly submitted upon request, giving the height, diameter, type of construction and kind of storage applying on tanks to be equipped.

COLUMBIAN STEEL TANK COMPANY

EST'D 1894

1401-1621 W. 12TH STREET KANSAS CITY, U.S.A.

LOUISIANA-ARKANSAS PROVEN AREAS

(Continued from Page 34)

W. M. Coates' No. 1 McNeely, NW cor. NE NW, Sec. 14-7-11 ... Began May 22; set 10-in. 90 ft; drlg. 800 ft.
W. M. Coates' No. 4-A Sabine Lbr. Co., Sec. 1-7-11 ... Bailing to test 2,297 ft.
O. A. Gautier et al's No. 1 Mischell, 330 ft. E, 150 ft. N, SW cor. SE NW, Sec. 30-8-12 ... S.D. 2,260 ft.
Hawkins & Antoon's No. 1 Newton, Sec. 1-7-11 ... Drill stem stuck 1,550 ft.
Jordan Drlg. Co.'s No. 2 La. Long Leaf Lbr. Co., Sec. 3-7-11 ... Arranging to set packer 2,455 ft.
Zeke Lohman's No. 1 McCormick, 660 ft. E, 330 ft. N, SW cor. NE SW, Sec. 2-7-11 ... Derrick.
Lyons & Neely's No. 1 Duggan, NW SE, Sec. 14-7-11 ... Location.
Lyons & Neely's No. 2 Byrd, Sec. 1-7-11 ... Set 6⅝-in. 2,408 ft.
L. K. McGuffin's No. 1 Bush, NW cor. NW SE, Sec. 1-7-11 ... Rigging up.
Ben Merritt, tr.'s No. 2 Byrd, Sec. 1-7-11 ... Derrick.
Pelican Nat. Gas Co.'s No. 9 La. Long Leaf Lbr. Co., 990 ft. W, 655 ft. N, SE cor. SW SE, Sec. 3-7-11 ... Dry and abd 2,671 ft.
George Pipes, tr.'s No. 1 Byrd, Sec. 1-7-11 ... Drlg. 1,750 ft.
Sabine Royalties Co., Inc.'s No. 1 Hill, 400 ft. S, 200 ft. E, NW cor. NE NE, Sec. 5-7-11 ... W.O.S.R. 2,506 ft.
Sabine Prod. Co.'s No. 2 Pearce, 858 ft. N, 530 ft. W, SE cor. SE NW, Sec. 10-7-11 ... Set 6⅝-in. 2,330 ft.
Sabine Royalties Co.'s No. 2 Hill, Sec. 32-8-11 ... Derrick.
Eddie Self's No. 1 Jacobs, Sec. 1-7-11 ... Coring 2,365 ft.
A. F. Tarver's No. 1 Cutrer, 330 ft. S and E, NW cor., Sec. 12-7-11 ... Began May 23; set 10-in. 80 ft; drlg. 650 ft.
The Texas Co.'s No. 1 DeLatia et al, 1,070 ft. W, 990 ft. N, SE cor., Sec. 3-7-11 ... Began May 23; set 10-in. 95 ft; drlg. 1,490 ft.
Houston-Sabine Prod. Co.'s No. 1 Sabine Lbr. Co. (was Triangle Pet. Co.'s No. 2 Sabine Lbr. Co.), 330 ft. N and E, SW cor., Sec. 36-8-12 ... Reaming 1,950 ft.
J. C. Walton's No. 1 Sabine Lbr. Co., 300 ft. S, 300 ft. W, NE cor. NW, Sec. 11-7-12 ... Tested 2,376 ft; S.O; W.O.

WEBSTER PARISH

Cassidy & Davis' No. 1 Nickerson, 300 ft. S, 300 ft. W, NE cor. SW, Sec. 29-23-10 ... S.D. 150 ft.

ARKANSAS

UNION COUNTY—EL DORADO

Lion O. & R. Co.'s No. 9-A G. P. Hayes, 242 ft. S, 246 ft. W, NE cor. Lot 5, NE, Sec. 4-16-15 ... Drlg. hard sandy shale 3,760 ft.
Southern Prod. Co.'s No. 1 Wingfield, NE cor. SE NW, Sec. 16-19-15 ... **S.D. 2,008 ft.**

UNION COUNTY—URBANA

Marine Oil Co.'s No. 1 Winn est., 330 ft. S and E, NE cor. 8¼ NW, Sec. 11-18-13 ... **Bailed 30% S.W; T.A. 3,586 ft.**
Marine Oil Co.'s No. 1 Union Sawmill Co., 330 ft. N and E, SW cor., SE SE, Sec. 3-18-13 ... Set 7-in. 2,532 ft.
Marine Oil Co.'s No. 2-E Thompson, 330 ft. N, 330 ft. E, SW cor. NE NE, Sec. 10-18-13 ... Location.
Wilson & Chapman's No. 1 Adkins, 330 ft. N and W, SE cor. SW NE, Sec. 3-18-13 ... Derrick.

EAST TEXAS

HARRISON COUNTY

Calatex O. & G. Co.'s No. 6 Argus, 755 ft. N, 699 ft. W, Mile Post 27, in J. Womack Sur. ... Location.

PANOLA COUNTY

Ark.-La. P. L. Co.'s No. 14 Werner, 341 ft. S, 300 ft. W, NE cor. Werner 74-ac. tr., Ben C. Jordon Sur. ... **Began May 23; set 12½-in. 150 ft;** drlg. 500 ft.
Daisy O. & G. Co.'s No. 1 Rucks, John Palmer Sur. ... S.D. 2,950 ft.
Dillon & Bradham's (was W. G. Banks et al's) No. 1 C. O. Baldwin, 1,395 ft. W, 1,362 ft. S, NE cor. Baldwin 230 ac. in Hampton West Sur. ... S.D. 1,555 ft.
S. E. Bell et al's No. 1 Burnett Lbr. Co., C, S. B. Hendricks Sur. ... S.D; W.O. 3,335 ft.
C. D. Neff et al's No. 6 Brumble, B. C. Jordan Sur. ... Derrick.
United Prod. Corp.'s No. 17 Steele, 1,320 ft. N, 660 ft. W, SE cor. C. D. Steele lse., in B. C. Jordan Sur. ... Location.
United Prod. Corp.'s No. 10 Warner, 388 ft. N, 2,467 ft. W, SW cor. Thos. Cox Sur. in Ben Jordon Sur. ... Set 9-in. 2,450 ft.
Southwestern O. & G. Co.'s No. 1 E. R. Vinson, 3,005 ft. S, 1,001 ft. W, NE cor. C. T. Anderson Sur. ... S.D. 2,650 ft.

MISSISSIPPI

HINDS COUNTY

Cleve Love et al's No. 2 Ridgeway-McGhee, SE cor. NW, Sec. 2-5-1e ... Derrick.

RANKIN COUNTY

Miss. G. & F. Co.'s No. 1 Hanna, SW cor. SW NE, Sec. 14-5-1e ... Derrick.

WILDCAT OPERATIONS IN MISSISSIPPI

CLARK COUNTY

Company, farm and location—	Remarks:
Gulf Ref. Co.'s No. 1 Box, 526 ft. W, 498 ft. N, C, SE, Sec. 11-2n-15e	Dry and abd. 4,515 ft.

CLAY COUNTY
(Cable tools)

Ohio Oil Co.'s No. 1 Cantrell, NE cor., Sec. 16-15-5 ... Drlg. 3,335 ft.

HINDS COUNTY

Attkisson & Dyer's No. 1 Downing et al, SE NE, Sec. 27-6-1 ... S.D. funds 1,980 ft.
Howard Oil Co.'s No. 1 Jackson College, C NW NW, Sec. 9-5-1e ... S.D. 74 ft.
Industrial G. & E. Co.'s No. 1 Ill. Central R.R., 2,400 ft. E, 100 ft. S, C, Sec. 4-5n-1e ... Completed May 25; estimated 25,000,000 ft. gas 2,468 ft.
Southern Pet. Co.'s No. 1 Wilson (was Tri-State O. & G. Co.'s), 320 ft. E, 240 ft. N, SW cor. SE NE, Sec. 28-6-1e ... S.D. 20 ft; W.O.

JASPER COUNTY

Bay Springs Pet. Co.'s No. 1 Keyes, C NW NE, Sec. 2-12-9 ... Drlg. 1,584 ft.

MONROE COUNTY

Amory Dev. Co.'s No. 1 Bourland, Sec. 2-13-19 ... S.D. 3,015 ft.
Park Bowser et al's No. 1 Cowart, second hole, Sec. 2-12-19 ... Bailing to test 2,235 ft.

NOXUBEE COUNTY

Thompson & Donohue's No. 1 Donohue, Sec. 25-16n-17e ... Derrick.

RANKIN COUNTY

Attkisson & Dyer's No. 1 Valentour, 300 ft. S, 200 ft. E, NW cor., Sec. 18-5n-3e ... Rigging up.
Grandstaff et al's No. 1 Carr, 2,750 ft. W, 550 ft. N, SE cor., Sec. 12-5n-1e ... Set 6⅝-in. 2,368 ft.
Harding & Flint's No. 1 Webb, center Lot 32, Blk. B, East Jackson Place, Jackson City Subd., Sec. 12-5-1 ... S.D. funds 880 ft.
R. A. Moore et al's No. 1 Interior Lbr. Co., Sec. 28-6-1e ... S.D. 960 ft.
Cleve Love's No. 1 Muse, SE cor. SW SW, Sec. 32-7-4e ... S.D. 4,000 ft.

SCOTT COUNTY

M. U. Culley et al's No. 1 Owens, Sec. 2-5-9 ... Derrick.

WARREN COUNTY

Eagle Bend O. & G. Co.'s No. 1 Kiger, SW cor. SW SE, Sec. 9-18-2 ... Set 12½-in. 186 ft; drlg. 852 ft.

WINSTON COUNTY

Miss. Drlg. Co.'s No. 1 Scarbrough, NW cor., Sec. 15-13-14 ... Arranging to make D.S. test 3,173 ft.

YALOBUSHA COUNTY

Collett-Carter Oil Co.'s No. 2 Blackmur, 990 ft. W, 285 ft. N, C, Sec. 11-11-4 ... Drlg. 3,100 ft.

WILDCAT OPERATIONS IN LOUISIANA-ARKANSAS

(Continued from Page 34)

E. T. Oakes' No. 1 R. H. Bryant et al, 200 ft. N and W, SE cor. NE NW, Sec. 30-13-15 ... Drlg. 1,375 ft.
Rellitt Oil Co.'s No. 1 Gannon Hrs., 300 ft. S and E, NW cor. NW NE, Sec. 12-11-16 ... Began May 21; set 10-in. 60 ft; drlg. 100 ft.
Walters-Nicholson, tr.'s No. 1 Jim Guy, Sec. 3-11-13 ... Moving in rig.

NATCHITOCHES PARISH

W. M. Coats' No. 1 Collins, 730 ft. N, 50 ft. E, C, Sec. 28-8-10 ... T.A. 4,091 ft.
J. W. Cooper et al's No. 1 Cooper, NW SW, Sec. 35-11-10 ... S.D. 3,156 ft.
Cooper et al's No. 2-A Cooper, C SE SE, Sec. 32-11-10 ... S.D. 1,518 ft.
C. M. Talley et al's No. 1 C. M. Talley, 1,980 ft. W, 660 ft. S, NE cor. SE, Sec. 29-11-10 ... Tested dry; S.D. 1,380 ft.

RED RIVER PARISH

La. Oil Dev. Co.'s No. 2 La. Delta Pecan Co., 2,950 ft. S, 300 ft. E, NW cor., Sec. 27-13-11 ... Spudded in; S.D. 50 ft.
Lucky Strike Oil Co.'s No. 1 Chaffraix, 200 ft. S, 200 ft. E, C, Sec. 32-12-10 ... Junked and abd. 3,010 ft.
Mack Jourden Co.'s No. 1 Lockett, 4,035 ft. S, 1,980 ft. E, NW cor. SW, Sec. 29, in Sec. 32-13-10 ... S.D.; rig repairs 800 ft.

RICHLAND PARISH

Alto Gas Co.'s No. 2 Hunt, 660 ft. S and E, NW cor., Sec. 13-17-5 ... Derrick.
Southern Carbon Co.'s No. 2 Rosengraut & Ducomb, 1,980 ft. N, 660 ft. E, SW cor., Sec. 19-17-6 ... Drlg. 2,268 ft.
Southern Carbon Co.'s No. 3 Rosengraut & Ducomb, 660 ft. S and E, NW cor., Sec. 30-17-6 ... Drlg. 1,645 ft.
Southern Carbon Co.'s No. 1-B C. M. Noble, 2,966 ft. N, 1,525 ft. W. cor. Secs. 7, 8, 17 and 18, in Sec. 37-15-6 Location.
United Gas Public Service Corp.'s No. 4 Earle, SE cor., Sec. 1-16-5e ... W.O.C. 2,465 ft.

SABINE PARISH

Durham Oil Co.'s No. 1 Polly (was Davis et al's), NE cor. NE NE, Sec. 18-8-12 (was Stacy et al's) ... Dry and abd. 2,732 ft.
Diffie & Barnett's No. 1 Lites (was J. W. Clark's), 330 ft. N, 330 ft. W, SE cor. SW NW, Sec. 34-8-11 ... S.D. 105 ft.
R. L. Clay, tr.'s No. 1-A Long Bell Lbr. Co., 430 ft. S, 200 ft. W, NE cor. NW NW, Sec. 10-8-13 ... Drlg. lime and shale 3,087 ft.
Lacey Prod. Co.'s No. 1 Cooper, 330 ft. N, 330 ft. W, SE cor. SW NW, Sec. 30-8-11 ... W.O.S.R; T.D. 2,620 ft.
Jean Longoria's No. 1 Belton (no check), Sec. 31-9-13. Set 8-in. 1,600 ft.
H. W. Perritt's No. 4 Bowman-Hicks, SE cor. SE NE, Sec. 2-7-12 ... Began May 21; set 10-in. 85 ft; drlg. 1,460 ft.
H. W. Perritt's No. 1 Boring, NW cor. NW NW, Sec. 11-7-12 ... 2,000 ft. oil in hole 2,602 ft; W. O.S.R.
Sabine Royalties Co.'s No. 1 Skinner, SW NW, Sec. 5-8-11 Set 6⅝-in. 2,270 ft.
Stovall Drlg. Co.'s No. 1 Nulton, SE cor. NW NE, Sec. 1-7-13 ... Set 6⅝-in. 2,075 ft.
A. H. Thames' No. 1 Edward est., 150 ft. NW SE cor. NE SE, Sec. 8-8-13 ... S.D. for wtr. 1,200 ft.
John Woodley's No. 1 Sabine Lbr. Co., 400 ft. S, 330 ft. W, NE cor. SE, Sec. 12-8-12 ... Dry and abd. 2,716 ft.

TENSAS PARISH

A. R. Willis et al's No. 1 Currey, 1,320 ft. S, 1,320 ft. E, NW cor., Sec. 29-11-12 ... S.D. for fuel 3,510 ft.

UNION PARISH

Nemours Corp.'s No. 1 McGaugh, 770 ft. N, 651 ft. E, SW NW, Sec. 24-22-3 ... Completed May 22; 3,197,000 ft. gas 2,185 ft.

WEBSTER PARISH

Coyle, tr.'s No. 1 Frazer, 200 ft. N, 200 ft. E, SW cor. NE SE, Sec. 27-23-11 ... Derrick.

WEST CARROLL PARISH

United Gas Public Service Co.'s No. 1 Pioneer Cooperage, 663 ft. E, 2,954 ft. S, NW cor., Sec. 29-21-9 ... Drlg. 2,508 ft.

ARKANSAS

CHICOT COUNTY

R. R. Smith's No. 1 Lytle, 660 ft. N, 660 ft. E, C, Sec. 21-23-3 ... T.A. 2,925 ft.

COLUMBIA COUNTY

Joe Modisette et al's No. 1 Sharklee, C SW NE, Sec. 33-16-19 ... Arranging to set 8¼-in. 965 ft.
Kendall Oil Co.'s No. 1 Fullenweider, Rhea & Kitchen Sec. 13-17-22 ... S.D. 778 ft.

CLAY COUNTY

S. C. Jeffus' No. 1 Underwood, 510 ft. N, 350 ft. W, C NW SE, Sec. 4-20-8 ... S.D; clearing titles 1,214 ft.

CLEBURNE COUNTY
(Cable tools)

Donnelly-Craver et al's No. 1 Donophan Lbr. Co., SE cor. NW, Sec. 33-11-9 ... S.D. 3,740 ft.

DALLAS COUNTY

E. C. Brewer's No. 1 W. E. Hillman, 330 ft. E, 40 ft. S, NW cor. SE NE, Sec. 20-10-13 ... S.D; W.O. 2,546 ft.
J. H. James, tr.'s No. 1 Fordyce Lbr. Co., 200 ft. S, 200 ft. E, NW cor. NW NE, Sec. 11-9-15 ... S.D. funds 2,520 ft.

GRANT COUNTY

Spann & McClung's No. 1 Sarah Page, 660 ft. W, 660 ft. S, NE cor. NW, Sec. 3-3-13 ... S.D. 1,024 ft.

HOT SPRINGS COUNTY

John Watkins' No. 1 Cunningham (was J. R. Lockhart's), 285 ft. S, 285 ft. W, NE cor., Sec. 11-5-16 Drlg. hard sand 617 ft.

LAFAYETTE COUNTY

Smitherman & McDonald's No. 1 Rogers, 330 ft. N and E, SW cor. NW SE, Sec. 17-15-22 ... Drlg. 1,420 ft.

LINCOLN COUNTY

Lawrence Cook, tr.'s No. 1 McGhee Planting Co., 420 ft. S, 220 ft. W, NE cor. NE SW, Sec. 5-3-7 ... Drlg. gummy shale 1,040 ft.

LITTLE RIVER COUNTY

Roberts Oil Co.'s No. 1 H. J. Russell, 330 ft. E, 330 ft. S, NW cor., Sec. 25-12-29 ... Location.

LOGAN COUNTY

J. H. Flowers' No. 1 J. H. White, Sec. 13-6-26 ... S.D; W.O. 3,570 ft.

MILLER COUNTY

East Texas O. & G. Co.'s No. 1 Harvey, 500 ft. E, 300 ft. S, NW cor., Sec. 2-15-26 ... T.A. 910 ft.
E. & F. Oil Co.'s No. 1 E. L. Beck, 200 ft. S, 200 ft. E, NW cor. SW, Sec. 36-15-26 ... T.A. 2,968 ft.
Fitzwater et al's No. 1 Beck, 200 ft. N, 200 ft. W, SE cor. SW SE, Sec. 23-15-26 ... T.A. 93 ft.
J. D. McRae's No. 1 Smith, 150 ft. N, 150 ft. W, SE cor., Sec. 26-15-26 ... Derrick.
W. E. Noel et al's No. 1 Dickson hrs., 1,980 ft. W, 660 ft. S, NE cor., Sec. 11-20-27 ... Location.

OUACHITA COUNTY

Copenhaven et al's No. 1 Elliott, Sec. 11-15-17 ... Bailed dry 2,210 ft; S.D; W.O.
Boling & McLeon's No. 1 L. D. Nealy, 150 ft. S, 150 ft. W, NE cor. SE SW, Sec. 25-16-15 ... Drlg. hard sandy shale 1,262 ft.

PIKE COUNTY

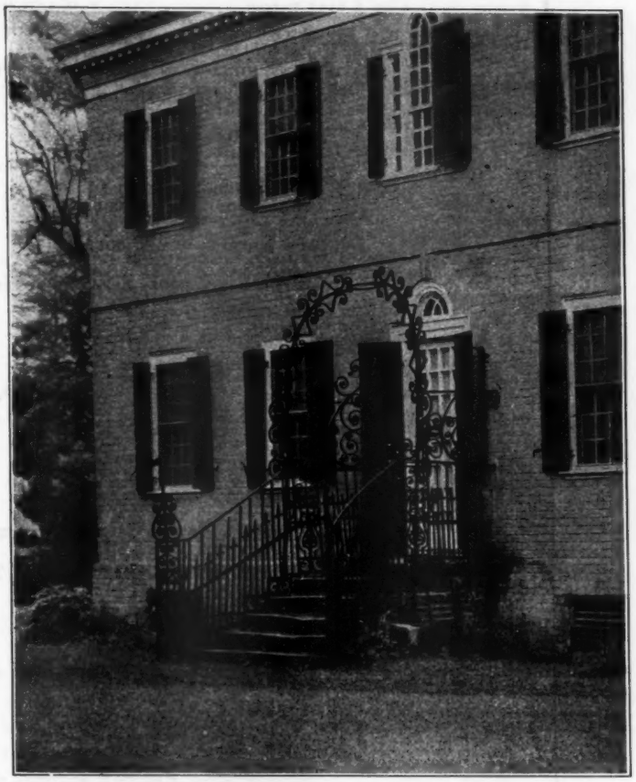
E. R. Henderson's No. 1 Tilyou, 660 ft. W, 500 ft. S, NE cor. NE SE, Sec. 26-8-14 ... T.A. 2,909 ft; (corrected depth).
E. R. Henderson's No. 1 J. L. Lee, 400 ft. S, 350 ft. E, NW cor. SW SE, Sec. 31-8-24 ... Drlg. hard rock 503 ft.

SCOTT COUNTY

Heavener O. & G. Co.'s No. 1 Riser, Sec. 36-4-26 ... S.D; T.D. 1,426 ft.
Waldron O. & G. Co.'s No. 1 White, NE cor. SW NW, Sec. 17-3n-29 ... S.D; waiting on csg. 1,860 ft.

UNION COUNTY

Chapman & Wilson's No. 1 A. H. Hadley, 330 ft. N, 330 ft. E, SW cor. NE SW, Sec. 3-18-13 ... 600 ft. fluid 30% S.W. in hole; T.A. 3,570 ft.



This simple, vigorous bit of decorative Wrought Iron was set where it would be exposed to the elements with the full confidence of its makers that it would survive the centuries. Even in Colonial days, Wrought Iron was well established as a metal of supreme endurance. It had already created thousands of records of resistance to rain, steam, salt air, smoke and fumes.

A century and a half of exposure did not damage this grill work of WROUGHT IRON

THE KIND THAT HIGHLAND MAKES

About the time our restless and rebellious forebears were dumping tea into Boston Harbor, writing and signing defiant declarations and generally making themselves unpopular with His Majesty, King George the Third, Littleton Dennis built this home, Beverly House, in Worcester County, Maryland.

He imported the Wrought Iron grill work from England. Today—about 150 years later—this lovely framing of the entrance facing the Pocomoke river is as little affected by the elements as if it had been installed last year.

It's Wrought Iron—the Kind that Highland Makes. Its structure contains millions of tiny microscopic layers of Iron Silicate that through the centuries repel the invasion of Rust.

Write us for more of the Wrought Iron story—and why it will save you money.

Oil Men Find Highland Wrought Iron a Short Cut to Important Savings

THE application of Highland Wrought Iron to bolts, nuts, sucker rods, roofing and tank plates, is one of the most important moves now being made in the oil field to cut down depreciation. In these uses, and others that are coming to light, Highland Wrought Iron has a steadfast resistance to corrosion that makes it the preferred metal of observant, careful engineers and managers.

THE HIGHLAND IRON AND STEEL COMPANY
General Sales Office:
400 West Madison St., Chicago

HIGHLAND WROUGHT IRON

ACCO

An Associate Company of the American Chain Company, Inc.

Wilson & Chapman's No. 1 N. Parker, 330 ft. S and W, NE cor. NE SE ..... Completed May 21; flowing by heads 250 bbls.

VAN BUREN COUNTY

Glenn Kohle et al's No. 1 Scalan, 200 ft. S, 200 ft. W, NE cor. SE NW, Sec. 5-19-13 ..... T.A. 50 ft.

WASHINGTON COUNTY
(Cable tools)

C. H. Willoughby's No. 1 Jones, Sec. 34-16-30..... S.D. for funds 1,795 ft.
H. H. Taylor et al's No. 1 Runny, C NE SW, Sec. 1-13-29. S.D. 1,700 ft.

YELL COUNTY
(Cable tools)

Tegmeier & Luckett's No. 1 Falcon, Sec. 36-7-21 ..... S.D. 5,710 ft.

EAST TEXAS

BOWIE COUNTY

Devore & Midfield's No. 1 Roy B. Cooper, 200 ft. S, 200 ft. W of NE cor. R. B. Cooper 115-ac. tr., Wm. Ward Sur. ..... Drlg. 2,025 ft.
Hindeman & Ball's No. 1 Merritt (was Maud-Redwater Oil Co.'s), 175 ft. N, 175 ft. E, SE cor. G. W. Hardidge 100-ac. tr. on Floyd Merritt tr. in Y. S. McKinney Sur. ..... Drlg. 2,385 ft.
Tarkington & Jones' No. 1 W. W. Whybark, 200 ft. S, 200 ft. W of SW cor. J. H. Dyer Sur. ..... Derrick.
Lee Timberlake et al's No. 2 Tidwell, 2,510 ft. N, 655 ft. W, SE cor. T. M. Rice Sur. ..... S.D; W.O. 3,000 ft; shale.

CAMP COUNTY

McDonald Bros.' No. 1 Tillery, 150 ft. E, 450 ft. S, NW cor. 127-ac. tr. in J. H. Murphy Sur. ..... S.D. 3,600 ft.

CASS COUNTY

E. K. Atkinson's No. 1 T. J. Wilson, 1,088 ft. S of N line, 2,376 ft. E of W line of H.R.S., J. R. McFarland Sur. ..... Derrick.
R. G. Baker's No. 1 W. R. Caver, on W. B. Caver 75-ac. tr., John Lick Sur. ..... Drlg. 1,650 ft.
Davis & Pigg's No. 1 Roy Brian, SW cor. Roy Bryan 88-ac. tr., Albert H. Latimer Sur. ..... S.D. 1,975 ft.
Everts Drlg. Co.'s No. 1 H. W. Whittington, 200 ft. S and W, NE cor. 69-ac. Whittington tr., L. Strong Sur. ..... Rigging up.
Geo. McKamie's No. 1 R. E. Hall, 150 ft. N, 150 ft. W, SE cor. Hall's 117-ac. tr., H. Buckler Sur. ..... S.D. 2,560 ft; chalk.
C. E. Murdock's No. 1 First National Bank, Evans Watson Sur. ..... S.D. 3,970 ft.
Olds & Smith's No. 1 Athens, 2,056 ft. W-E line, 856 ft. S-N line, J. C. Byers Sur. ..... S.D. changing boiler; 2,308 ft.
John C. Rogers' No. 1 I. E. Lanier, 573 ft. N, 879 ft. W, SE cor. Lanier 86 ac. in K. E. Welborn Sur. .... S.D. 2,275 ft.
John C. Rogers et al's No. 1 W. Q. Henderson, 3,100 ft. S, 3,100 ft. E, NW cor., Wm. Davis Sur. ..... S.D. 955 ft.

HARRISON COUNTY

Wm. H. Atkinson's No. 1 O. D. Hays, 900 ft. E, 150 ft. S, NW cor. O. D. Hays' 46-ac. tr., J. H. Chaffin Sur. Dry and abd. 2,870 ft.
Ben Banner's No. 1 J. C. Lowery, in center of J. C. Lowery 81-ac. tr., W. D. Stanfield Sur. ..... Set 6-in. 2,797 ft; arranging to test 2,804 ft.
Everett Prod. Co.'s No. 1 R. L. Gypert, 1,320 ft. W of NE cor., 150 ft. at right angles from NE cor. of E. M. Wilder Sur. in Richard Hooper Sur. ..... Drlg. 2,540 ft.
Gholson et al's No. 1 Bivins Farm Co., on J. K. Bivins, Jr.'s 320-ac. tr., Thos. Toby Sur. ..... Rigging up.
O. O. Olford et al's No. 1 R. W. Bolding, 330 ft. E of SE cor. J. B. Cullen's 161-ac. tr., 300 ft. N of N line of Mrs. C. L. Brown's 20-ac. tr., W. W. O. Stanfield Sur. ..... S.D. 2,050 ft.
Geo. L. Pace et al's No. 1 T. G. and Eugene Barker, 710 ft. N of S line, 1,930 ft. W of E line, SE cor. 230-ac. tr., Victor Pedraso Sur. ..... S.D. 4,116 ft.
O. H. Parkening's No. 1 T. J. Taylor, C, Blk. 32, W. H. Payne Sur. ..... Drlg. chalk 1,920 ft.
O. H. Parkening's No. 2 T. J. Taylor, C, J. C. Hawley Sur. ..... Derrick.
Rowan & Nichols' No. 1 Bussey est., center of Bussey 125-ac. tr., E. H. Merchant Sur. ..... Drlg. shale 3,217 ft.
Ryan Consolidated Pet. Corp.'s No. 1 Dr. H. H. Key, 1,500 varas N of SE line, 500 varas E of SW line, of E. Carroll Sur. ..... Began May 25; set 12½-in. 458 ft.
Seigel Bros. and Kelinson's No. 1 Taylor (no check), F. O'Neil Sur. ..... Derrick.
Thomas & Kinsey's No. 1 J. R. Watson, Thos. Iden Sur. . Derrick.

MARION COUNTY

Gist, Claunch & Dodson's No. 1 Miller, 1,470 ft. E line, 725 ft. N line, SW cor. H. Fulgran H.R. Sur. ..... Rigging up.
Geo. Hindman et al's No. 1 F. V. Lindsey, 2,500 ft. S, most northerly N line, 3,555 ft. E most easterly W line, Alexander Albright Sur. ..... Drlg. 2,685 ft.
Hindeman & Rhondo's No. 1 McGaughey, 1,547 ft. W, most northerly SW cor., 1,638 ft. N most northerly S line, W. J. Willis Sur. ..... S.D. 3,025 ft.
P. E. Hussey's No. 1 A. A. Trammell, Chas. Lockhart Sur. ..... S.D. 1,884 ft.
Shelton et al's No. 1 J. M. McNeal, 800 ft. S, 400 ft. W, NE cor. McNeal's 721-ac. tr., R. Fowler Sur. .... Drlg. 1,020 ft.

PANOLA COUNTY

Everette Drlg. Co.'s No. 1 E. L. McDaniels, 200 ft. S, 200 ft. W, NE cor. McDaniels' 116 ac., Alanson Barr Sur. ..... Dry and abd. 1,315 ft.
Hoffer et al's No. 1 Cameron Lbr. Co., center 1,306-ac. tr. in W. M. A. LaGrove Sur. ..... Derrick pattern.
Moses & Wallace's No. 1 Daniel, 600 ft. N and W lines, Mrs. Gerrell 100-ac. tr., SW cor. Isabel Hanks Sur... Derrick.
Jeffus & Lee's No. 1 Latham, Wm. Rich Sur. ..... Began May 19; set 10-in. 40 ft; drlg. 450 ft.
J. L. Nelson et al's No. 1 J. W. Williams, 300 ft. S, 700 ft. W, NE cor. Williams' 67-ac. tr. in Jas. Hanks Sur. ..... Derrick.
The Texas Co.'s No. 2 G. W. Brumble, 400 ft. S, 200 ft. E, NW cor., Jno. Womack Sur. ..... Tested 800 bbl. S.W; 1,000,000 ft. gas 4,751 ft; abd.

RED RIVER COUNTY

D. M. Buffington's No. 1 Hossler, E. Hughhart Sur. .... S.D. 2,795 ft.
Johnson Pet. Co.'s No. 2 Randolph, Edw. Dean Sur. .... S.D. 2,280 ft.

SHELBY COUNTY

I. M. Bradley's No. 1 Ashberry (no check), G. W. Mitchell Sur. ..... Drlg. gummy shale 2,390 ft.
E. L. Chapman's No. 1 Pickering Lbr. Co., C. E. Henry (headright) ..... Drlg. 3,390 ft.
Chapperell Oil Co.'s No. 2 Holt, Matthew Moore Sur. .. S.D. 3,111 ft.
H. H. Graccy's No. 1 J. A. Morrison, 1,500 ft. N, 200 ft. E, SW cor. J. A. Morris' 109-ac. tr., Wm. English Sur. ..... Drlg. 1,610 ft.
Joiner et al's No. 1 Foster & Billingsly, 150 ft. W of CEL Foster & Billingsly's 109-ac. tr., J. Bowlin Sur.. Moving in rig.
T. A. Martin's No. 1 J. B. Bush, S 8° E, 2,000 ft. from NW cor. J. B. Bush's 77-ac. tr., thence E at right angles to said line 200 ft., Alfred Lindsey Sur. ..... Moving in rig.
Henry Maulding's No. 1 Frost Lbr. Co., NE cor. Frost Lbr. Co.'s 80-ac. tr., A. D. Fountain Sur. ..... Drlg. 1,880 ft.
Schultz et al's No. 1 Hughes, 150 ft. SW cor. Hughes' 110-ac. tr., J. Clay Sur. ..... Drlg. hard sandy shale 1,615 ft.
Sloan Prospecting Co.'s No. 1 Sanford, approximately 300 ft. N and 200 ft. E, SW cor. B. Sanford 49-ac. tr. in M. M. Vann Sur. ..... Drlg. hard chalk 2,405 ft.
Sloan Prospecting Co.'s No. 1 Windham, H. English H.R.S. ..... Testing in broken chalk 3,389 ft.
C. H. Tautenhahn's No. 1 J. C. Bogard, 300 ft. S, 900 ft. E, NW cor. J. C. Bogard's 52-ac. tr., Thomas Baker Sur. ..... Derrick.

SOUTHWEST TEXAS PROVEN AREAS

(Continued from Page 38)

SAXET FIELD—NUECES COUNTY

Gulf Coast Oil Co.'s No. 1 Maggie Harrall, 330 ft. from S and W lines of Blk. 32, Sec. 311 ..... T. D. 4,095 ft.; set csg.; showing oil.
Houston Oil Co.'s (Andy Bowen) No. 1 Prieur, H. B. Sheppard Sur. ..... T. D. 1,465 ft.; waiting for csg.
Houston Oil Co.'s No. 1 Lawrence ..... T. D. 2,740 ft.; running wild.
Houston Oil Co.'s No. 2 Rand Morgan ..... T. D. 4,516 ft.; coring sand.
L. L. Smith's No. 1 Hunter, 150 ft. from S and W lines of N half of Hunter tract ..... T. D. 4,183 ft.; drlg.
Saxet Oil Co.'s No. 8 Dunn, 1,000 ft. N, 500 ft. W of No. 7 Dunn ..... T. D. 4,277 ft.; set csg.

WHITE POINT FIELD—SAN PATRICIO COUNTY

Saxet Oil Co.'s No. 4 White Point ..... T. D. 5,365 ft.; drlg.

CAROLINA-TEXAS POOL—WEBB COUNTY

George S. Marshall's No. 1 Benavides, 660 ft. from S line, 150 ft. from E line of Sur. 683 ..... Location.

PRYOR FIELD—ZAVALA COUNTY

Texas Gas Utilities' No. 4 Pryor, 1,000 ft. NW of No. 3 Pryor ..... T. D. 708 ft.; comp. 4,000,000 ft. gas.

LAREDO DISTRICT

KOHLER POOL—DUVAL COUNTY

Humble Oil & Refining Co.'s No. 50 Kohler, 2,805 ft. from S line, 165 ft. from W line of Sur. 164 ..... T. D. 6,230 ft.; drlg.

COLE COUNTY—DUVAL COUNTY

Magnolia Pet. Co.'s No. 1 W. Benavides, 330 ft. from N and W lines, Sur. 172 ..... Drlg. 2,270 ft.

JENNINGS-MUCKELROY POOL—ZAPATA COUNTY

Allied Oil & Gas Co. and Allen & Morris' No. 15 Guitierez, 2,317 ft. NE line, 200 ft. SE line of Share 4, Fansler Partition, Comitas grant ..... T. D. 1,485 ft.; comp. 150 bbls. oil.
E. C. Brogan's No. 2 Montemayor, 450 ft. from N line, 150 ft. from W line of Blk. 11, Sur. 64 ..... Rigging up.
O. W. Killam's No. 8 Bustamente, 715 ft. SE line, 622 ft. SW line, Blk. 7, Share 5, Fansler's Partition, Comitas grant ..... Set csg. 1,253 ft.; comp. 40 bbls. oil.
Trevino Oil Corp.'s No. 9 I. G. Trevino, Sur. 412 ..... T. D. 1,207 ft.; comp. 50 bbls. oil.
O. W. Killam's No. 9 Bustamente, Blk. 7, Share 5, Comitas grant ..... Rigging up.
Pal-mar Oil Co.'s No. 1 Bustamente, 150 ft. from NE and SE lines, Blk. 11, Share 5, Comitas grant ..... Location.
Pray & Chamberlain's No. 5 Garza, 750 ft. to NW line, 450 ft. to NE line, Blk. 1, Zorro Subd. of Comitas grant ..... Rigging up.

WILDCAT OPERATIONS IN SOUTHWEST TEXAS

(Continued from Page 38)

BEXAR COUNTY

Ingersoll-Miller's No. 1 E. B. Carruth, 1,900 ft. S of Medina River, 1,520 ft. to W line of lease, in Francisco Rolen Sur. ..... T. D. 520 ft.; shut down.
Ingersoll-Miller's No. 2 E. B. Carruth, 750 ft. S of No. 1 ..... Location.
John F. Camp.'s No. 1 Chevez, 12 miles S of San Antonio ..... T. D. 2,400 ft.; drlg.
J. M. Russell's No. 1 F. L. Price, 1,500 ft. to N line, 660 ft. W of tract in Angel Navarro Sur. ..... T. D. 1,320 ft.; drlg.
Schneider, Rees et al's No. 2 Claussen, 12 miles NE of San Antonio ..... T. D. 702 ft.; shut down.

CALDWELL COUNTY

Mills et al's No. 1 McMahon, 275 ft. SW line, 75 ft. SE line of tract, J. Pinchback Sur. ..... T. D. 2,430 ft.; drlg.
M. O. Rayor's No. 1 Dunlap, 150 ft. NW and NE lines of farm, Solomon Seal Sur. ..... T. D. 2,186 ft.; drlg.
R. R. Ogden's No. 1 O. S. Alexander, 1,300 ft. from N line, 150 ft. from E line of S. Spiller Sur. ..... T. D. 2,338 ft.; testing show in Edwards.

COMAL COUNTY

Caldwell & Lanier's No. 1 T. J. Byler, 175 varas from W line, 370 varas from N line of 320-ac. tract in the H.E.&W.T. No. 5,894 Sur. ..... T. D. 698 ft.; shut down.

DEWITT COUNTY

Gibson & Sturm's No. 1 Clark, Dolores Alderete Sur. ... Rigging up.

DUVAL COUNTY

Coffee et al's No. 1 Jose Garza, center Sur. 49 ..... T. D. 900 ft.; changing rig.
Magnolia Pet. Co.'s No. 1 W. Benavides, 330 ft. N and W lines of Sur. No. 172 ..... T. D. 2,465 ft.; set csg. to test gas show.
O'Byrne et al's No. 1 Well, B.S.&F. Sur. No. 568 ..... T. D. 1,830 ft.; repairing boiler.
S. J. Carpenter et al's No. 1 Juan Benavides, Blk. 32, Mesquite grant ..... T. D. 1,669 ft.; tested salt water; drlg. deeper.

FAYETTE COUNTY

Elam & Reynolds' No. 1 Florence, M. Muldoon Sur. No. 13 ..... T. D. 2,200 ft.; shut down.

GUADALUPE COUNTY

Harry J. Bruner's No. 1 Jim Sherrill, 150 ft. N line, 1,360 ft. W line of tract, George Allen League ..... T. D. 678 ft.; ratholing for csg. seat.
McGarrity et al's No. 1 A. Wesch, Jr., 150 ft. to N and E lines of farm, H. M. Thompson Sur. ..... T. D. 807 ft.; changing to heavier rig.
Schleyer, Atherton and Armstrong's No. 1 Ogletree, Robert Smith Sur. ..... T. D. 1,530 ft.; shut down.
Linne et al's No. 1 J. E. Linne, center 263-ac. tract in V. Cortario Sur. ..... Moving in tools.
San Antonio Oil & Royalty Co.'s No. 1 Dibrell, 150 ft. from N and W lines of Sec. 6, H.&T.C.R.R. Sur. .... Location.
W. J. Walton's No. 1 Zoboroski, 700 ft. to W line of tract, 500 ft. S of Guadalupe River, in Joseph D. Clements Sur. ..... T. D. 50 ft.; set surface csg.; waiting on cement.

HAYS COUNTY

J. C. Jones et al's No. 1 Byder, John Ingram Sur. ..... T. D. 900 ft.; drlg.

JIM HOGG COUNTY

Magnolia Pet. Co.'s No. 1 Cuellar, Sur. No. 575 ..... T. D. 4,374 ft.; drlg.
Peterman & Minahan's No. 1 Palacios, Sur. No. 231 .... T. D. 1,360 ft.; shut down.
D. C. DeWitt's No. 1 Teofilo Gomez, 1,170 ft. from N line, 150 ft. from W line of Sur. 12 ..... T. D. 200 ft.; shut down.

JIM WELLS COUNTY

Gulf Production Co.'s No. 4 Schaeffer ..... Location.
Prairie Lee Prod. Co.'s No. 1 Oppenheimer ..... T. D. 1,000 ft.; shut down; waiting for heavier rig.
Smith Clark Co.'s No. 1 Cuero Cattle Co. ..... Dropped till work is resumed.

KENDALL COUNTY

Borgett et al's No. 1 Hagg, W. Avery Sur. ..... T. D. 1,165 ft.; shut down.
Dixon Oil Co.'s No. 1 Ottmar Behr, 823 ft. from S and N lines of Jessie Wilson Sur., 3 miles S of Sisterdale ..... T. D. 2,625 ft.; drlg.
Sitton et al's No. 1 Garvin, C of NE of D. L. Richardson Sur., in the D. L. Richardson Sur., 1 mile NE from Kendalia ..... T. D. 1,467 ft.; sidetracking.
Fred S. Dibble's No. 1 Ellebrach, Sur. 77, N part of county ..... Spudded in and shut down.
Hicks et al's No. 1 Speck & Wiedner, Thomas Sur. No. 27, 3 miles S of Twin Sisters ..... Location.
Permian Oil Co.'s No. 1 Taylor, Sec. 18, G.B.&G. Sur. .... T. D. 1,967 ft.; drlg. hard lime.

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KERR COUNTY

Herbert Oil Co.'s No. 1 J. D. Witt, 1,320 ft. N line, 1,320 ft. W line of Sec. 1,923, W. H. Hamilton Sur.... Moving in.
Evans & Gant's No. 1 Selker-Mears, C.C.S.D.&R.G.N.G. Sur. No. 1,606 ..... T. D. 1,900 ft.; drlg.
Evans & Gant's No. 1 E. Young, A. E. Burge Sur. No. 28 ..... Rigged up and shut down.
Evans & Gant's No. 2 Love, 150 ft. to S and W lines of Sur. 1,593 ..... Rigging up.
Evans & Gant's No. 1 Jeff Love, 1,320 ft. from W line of Sur. 1,594 and 660 ft. S of S line of Sur. 1,597 .. .. T. D. 3,391 ft.; to deepen.
B. M. Hatfield's No. 1 Westland, Blk. 23, Westland Subd. to Kerrville ..... T. D. 460 ft.; standing.

KIMBLE COUNTY

C. L. Bryant et al's No. 1 Lambert, 7,700 ft. N and W lines of F. Lotta Sur. ..... T. D. 850 ft.; standing.
Kamon et al's No. 1 Hodges ..... T. D. 2,910 ft.; shut down.

KINNEY COUNTY

C. R. Cox et al's No. 1 Rose, 1,344 varas from NW line, 109 varas from SW line of A. B. Harper Sur. ..... Location.

LASALLE COUNTY

Fred W. Vales' No. 1 Coleman, 200 ft. from S and E lines of SW Sec. 514, B.S.&F. Sur. ..... T. D. 40 ft.; abnd.

LAVACA COUNTY

F. P. Zoch's No. 1 Dobard, 950 ft. from N line, 150 ft. from W line of T. G. Western Sur. ..... Rigging up.

LIVE OAK COUNTY

Burke-Greis Oil Co.'s No. 1 West Ranch, James Vaughan Sur. ..... T. D. 2,680 ft.; drlg.
Henderson Coquat's No. 1 Hewitt ..... T. D. 54 ft.; set surface csg.
Illinois Exploration Synd.'s No. 1 Reeves-Brown, 1,300 ft. S of Seliers tract, 1,800 ft. E of Ry. ..... T. D. 2,145 ft.; standing.
Sid Keughan's No. 1 C. E. Terrell, 600 ft. from N line, 1,000 ft. from E line, Dan O'Boyle Sur. ..... T. D. 2,840 ft.; shut down.

LEE COUNTY

Burt et al's No. 1 R. C. Saunders, J. Maxmilian Sur. .... T. D. 3,718 ft.; drlg.
A. H. Wheeler and associates' No. 1 fee, Blk. 47, H. Donohue Sur. ..... T. D. 3,300 ft.; showing oil; will set csg.
C. B. Polk et al's No. 1 Stoltz, Hiram Donohue Sur. .... T. D. 2,100 ft.; drlg.

McLENNAN COUNTY

C. E. Groone et al's No. 1 League ..... T. D. 1,230 ft.; shut down.

McMULLEN COUNTY

Belt Pet., Inc.'s No. 1 Martin, 150 ft. NW line, 150 ft. to SW line of E. Melon No. 212 Sur. ..... T. D. 28 ft.; standing.
Camp and Stancliff's No. 1 Murphy, 1,845 ft. from W line, 165 ft. from N line, Sur. 123 ..... T. D. 475 ft.; drlg.
Whall, Scherer et al's No. 1 Shiner, Henry Brewer Sur... T. D. 1,630 ft.; shut down.

MEDINA COUNTY

J. H. Hickey's No. 1 Jungman, at N end Chicon Lake .... T. D. 425 ft.; drlg.
Sunflower Oil Co.'s No. 1 Mofield, J. Brothag Sur. No. 532 ..... T. D. 1,962 ft.; drlg.
F. E. Tegler's No. 1 J. P. Nixon, 600 ft. from W line, 584 ft. from N line of tract, near Ina Field ..... T. D. 155 ft.; drlg.
Yancey Development Co.'s No. 1 Fassler, Sur. No. 801 .... T. D. 1,650 ft.; drlg.

MILAM COUNTY

Dil-Tex Oil Corp.'s No. 1 Dilbeck, 450 ft. N and E lines of farm, Fernando Rodrigues Sur. ..... T. D. 2,070 ft.; drlg.
H. Elliott's No. 1 Kirkman, 150 ft. from NE lines of farm in M. Park Sur., NW from Gabriel ..... T. D. 1,470 ft.; drlg.
Rheubotham & Tate's No. 1 Johnson, 325 ft. from N line, 250 ft. from W line of 40-ac. tract, D. Robinson Sur. ..... T. D. 2,192 ft.; abnd.
Red Bank Oil Co.'s No. 1 Foster, A. G. Berry Sur. ..... Derrick blown down.
McMasters and Pomeroy's No. 1 Pluger, J. J. Acosta Sur... T. D. 1,606 ft.; shut down.
J. E. McKee et al's No. 1 Littleton, 150 ft. from N and 225 ft. from W line of lease, C. Chevalier Sur. .... T. D. 510 ft.; shut down.
Peggie Brothers' No. 1 M. Reed ..... T. D. 1,390 ft.; abnd.

REAL COUNTY

McGinley Corp.'s No. 1 Haby, C of SW Sec. 175 ..... T. D. 1,790 ft.; waiting for drill line.
Gant-Kilgore and Evans' No. 1 A. D. Auld, C.C.S.D.& R.G.N.G. Sur. No. 23 ..... T. D. 3,310 ft.; set new string csg.

STARR COUNTY

B. B. Tips' No. 1 F. Dayne, Lot 1, Porcion No. 81 ..... T. D. 332 ft.; standing.
Menyard et al's No. 1 Sealbury, 150 ft. from E line, 6,-550 ft. from N line, Share 5, Porcion 75, Jurisdiction of Carmargo ..... T. D. 411 ft.; tested dry.
Los Olmos Oil Co.'s No. 4 Kelsey-Bass, 2,208 ft. from W line, 60 ft. from N line, Blk. 7, Subd. Porcions 75, 76 and 77, Jurisdiction of Carmargo ..... T. D. 410 ft.; set csg.

TRAVIS COUNTY

F. W. Fuchs' No. 1 Ballersted, A. Alexander Sur. ..... Derrick.
Franklin et al's No. 1 Wilson, A. Alexander Sur. ..... Derrick.
Ratcliffe et al's No. 1 Jim Jones, 1,000 ft. S line, 750 ft. E line of farm in Amos Alexander Sur. ..... T. D. 305 ft.; drlg.
Waldron et al's No. 1 Cook, D. H. Minor Sur., 8 miles SW of Austin ..... T. D. 645 ft.; drlg. shale.

WEBB COUNTY

Cole Pet. Co.'s No. 4 Benavides, Sur. No. 1,601 ..... T. D. 2,000 ft.; drlg.
Eugene Garner, Jr.'s No. 1 Billings, 411 ft. E line, 956 ft. N line of NW NE, Sur. 71 ..... Location.

WILLIAMSON COUNTY

Wilburn et al's No. 1 Caroline Hurts, P. Coursey Sur. .... T. D. 1,327 ft.; shut down.
Wilson et al's No. 1 Walker ..... T. D. 2,260 ft.; shut down.
A. M. Blume's No. 1 Nickolson, C. Dias Sur. ..... T. D. 745 ft.; drlg.

ZAPATA COUNTY

T. H. Ward's No. 1 Uribe, 150 ft. NW line, 150 ft. SW line, Blk. 8 Subd., Share 7, Partition No. 6, T. Uribe Partition of Jose V. Borrego Sur. ..... Rigged up and standing.
Benson Oil Co.'s No. 1 S. Vela, W cor. of Blk. 13, Sur. No. 259 ..... T. D. 2,500 ft.; abnd.
Bill Henry et al's No. 1 Gopher Trust estate, Borrego grant ..... T. D. 1,398 ft.; drlg.
Penny Prod. Co.'s No. 1 Juan V. Cuellar, Jr., et al, 175 ft. NE line, 175 ft. SE line Poppas Subd., Porcion 33 and 34, Blk. 1, Sur. 2 ..... T. D. 2,035 ft.; drlg.
National Oil Co.'s No. 1 Zapata Trust Estate, 617 ft. Porcion 6 ..... T. D. 690 ft.; drlg.
NW line, 96 ft. NE line, Blk. 97, De Prom Subd.,
National Oil Co.'s No. 2 Adams, 150 ft. from NW line and SW line, Blk. 11, Borrego grant ..... T. D. 1,220 ft.; drlg.
Mackenzie & Talmadge's No. 1 Trevino, 400 ft. SE line, 200 ft. NE line, Blk. 6, Sur. No. 4, Porcion 2 and 3 ..... T. D. 520 ft.; standing.

GULF COAST FIELDS AND WILDCATS

(Continued from Page 36)

Sun Oil Co.'s No. 2 Winfree, W. D. Smith Sur., 450 ft. SE along SW line from NW cor. of tract and 50 ft. NE at right angles ..... Drlg. rock 3,022 ft.
Sun Oil Co.'s No. 1 Anna Higgins, Wm. Bloodgood Sur., 230 ft. from E line and 31 ft. from S line 10-ac. tract ..... Spudded.
The Texas Company's No. 2 Winfree, west flank, W. D. Smith Sur., 264 ft. N, 50 ft. W at right angles out of SE cor. of lease ..... Drlg. hard sand showing oil 5,500 ft.
The Texas Company's No. 3 Winfree, west flank, W. D. Smith Sur., 478 ft. N and 50 ft. W at right angles .. Set 174 ft. 11-in. 6⅝-in. screen 5,630 ft.; to test.
The Texas Company's No. 4 Wilburn (D.D.), Henry Griffith League, approximately 1,700 ft. from W line and 50 ft. from S line of tract ..... Tested salt water 5,392 ft.; pulled screen to deepen.
The Texas Company's No. 6 Wilburn, Henry Griffith League, 250 ft. W of No. 4 and 50 ft. from S line of lease ..... Cem. 13⅜-in. surface pipe 1,512 ft.
Yount Lee Oil Co.'s No. 9 Chambers (D.D.), William Bloodgood Sur., 550 ft. from N line and 1,660 ft. from W line of tract ..... Set screen 5,515 ft.
Yount Lee Oil Co.'s No. 3 Winfree, W. D. Smith Sur., 190 ft. out of NE cor. of tract ..... Drlg. shale and lime 4,747 ft.

RACCOON BEND—AUSTIN COUNTY

Humble and Valley's No. 1 Martha Remmert ..... Location.

HUMBLE—HARRIS COUNTY

Rio Bravo Oil Co.'s No. 2 H.E.&W.T., Adams Sur., 250 ft. N along railroad tract from No. 1 and 25 ft. W from center of said tract ..... Drlg. shale and lime 4,407 ft.
Rio Bravo Oil Co.'s No. 1 Westheimer, John Brown Jones One-Third League, 800 ft. from E line and 100 ft. from S line of Blk. 1, in Lot 48, Westheimer Subd. ..... Location.
Sun Oil Co.'s No. 16 Bender, Adams Sur., Bender South Addition, 110 ft. N of N line of H.E.&W.T., 150-ft. right of way and 75 ft. E of C line of right of way.. Drlg. shale 4,020 ft.
Sun Oil Co.'s No. 24 Bender, W. B. Adams Sur., 24 ft. N of Rio Bravo's No. 2 H.E.&W.T. on Sun's east line ..... Shut down 2,147 ft.

PIERCE JUNCTION—HARRIS COUNTY

Rio Bravo Oil Co.'s No. 14-A Settegast (workover) ..... Sand and shale showing oil 5,375 ft.; to test.
Rio Bravo Oil Co.'s No. 22-A Settegast, J. Kopman Sur. No. 44, 900 ft. S and 200 ft. W of NE cor. "A" lease.. Spudded.

LOST LAKE—CHAMBERS COUNTY

Pure Oil Co.'s No. 13 Mayes, B.B.B.&C. Sur. No. 4, 75 ft. W and 700 ft. S of NE cor. of survey ..... Drlg. sticky shale with streaks of lime 4,802 ft.

HIGH ISLAND—GALVESTON COUNTY

Yount Lee Oil Co.'s No. 21 Cade, Fitzsimmons Sur., 150 ft. W of No. 17 ..... No report.

NORTH DAYTON—LIBERTY COUNTY

Harrison-Abercrombie's No. 2 Jones, H.&T.C. Sur. No. 125, 50 ft. from N line and 450 ft. from E line of tract ..... No report.

ORCHARD—FORT BEND COUNTY

Gulf Prod. Co.'s No. 29 Moore, John Frazier Sur., 600 ft. N of No. 26 in line with Nos. 23 and 26 ..... Set screen 4,157 ft.

DAMON MOUND—BRAZORIA COUNTY

D. C. Wellock's No. 1 Ramon, John P. Mills Sur., 1,115 ft. NE line and 60 ft. W line Blk. 1 ..... Shut down 400 ft.

ALLEN—BRAZORIA COUNTY

Mills Bennett Prod. Co.'s No. 1 Poole, T. & W. Alley League, 1,350 ft. from E line and 100 ft. from S line (workover) ..... Shut down; total depth 4,902 ft.

CLAY CREEK—WASHINGTON COUNTY

Sun Oil Co.'s No. 5 Carraway, J. F. Perry Sur., 600 ft. NW No. 2 and 200 ft. from W line ..... Total depth 1,992 ft.; plugged to 1,350 ft.
Sun Oil Co.'s No. 6 Jamer, J. F. Perry Sur., 600 ft. NW No. 5 and 1,200 ft. from SW line ..... Cem. 13⅜-in. surface pipe 145 ft.

ESPERSON—LIBERTY COUNTY

Cranfill-Reynolds Oil Co.'s No. 7 Davis, David Kokernot Sur., 100 ft. S of No. 4 ..... Drlg. sandy shale 5,354 ft.
Cranfill-Reynolds Oil Co.'s No. 2 Moore's Bluff (workover) ..... No report.

BLUE RIDGE—FORT BEND COUNTY

Telschow, Cady et al's No. 5 Blakely, E. Drew Sur., 90 ft. E, 150 ft. S of NW cor. of E half, Lot 4, Blk. F .. Oil sand 2,980 ft.; standing cemented.

HANKAMER—LIBERTY COUNTY

Gulf Prod. Co.'s No. 14 Boyt, H.&T.C. Sur. No. 32, 500 ft. N of No. 10 ..... Drlg. gumbo 1,310 ft.

SARATOGA—HARDIN COUNTY

Rio Bravo Oil Co.'s No. 116-A Cotton ..... Comp. 10 bbls. oil 500 ft.
Rio Bravo Oil Co.'s No. 117-A Cotton ..... Drlg. 110 ft.

MOSS BLUFF—LIBERTY AND CHAMBERS COUNTIES

Humble Oil & Ref. Co.'s No. 2 Sergeant, east flank ..... Standing 5,931 ft.
Humble Oil & Ref. Co.'s No. 7 Sterling, J. McFaddin Sur., 350 ft. S and 100 ft. W No. 6 Sterling ..... Drlg. shale 5,985 ft.
Texas Gulf Sulphur Co.'s No. 1 V. R. McManus, B. M. Spinks Sur., 200 ft. S and 100 ft. W of NE cor. 125-acre tract ..... Sulphur test.
Texas Gulf Sulphur Co.'s No. 2 D. J. Harrison, B. M. Spinks Sur., 2,600 ft. E and 100 ft. N of SW cor. tract. Sulphur test.
Texas Gulf Sulphur Co.'s No. 1 R. W. Sargent, McFaddin Sur., 3,400 ft. E and 250 ft. N of SW cor. tract ..... Sulphur test.

REFUGIO—REFUGIO COUNTY

Houston Oil Co.'s No. 10 Wilson Heard, Refugio town tract, 150 ft. from N line and 150 ft. from E line of S 50-acre tract ..... Drlg. sticky shale and lime 2,384 ft.
Houston Oil Co.'s No. 5 Mrs. M. H. Ryals, Refugio town tract, 150 ft. from N line of tract and 527 ft. east of No. 1 ..... Oil sand 3,624-55 ft.; cem. 7-in. casing 3,624 ft.
Houston Oil Co.'s No. 6 Pratt-Hewitt-Rooke (D.D.), Thomas Mullen Sur., 1,150 ft. N and 200 ft. W of SE cor. of tract ..... Total depth 3,708 ft.; sidetracking in sticky shale 3,515 ft.
Larco Oil & Gas Co.'s No. 1 Strauch, C Lot 13, Blk. 2 ... Total depth 3,695 ft.; set 20 ft. screen in sand 3,671-90 ft.; swabbing.
Mission Drilling Co.'s No. 2 J. J. O'Brien, Refugio town townsite ..... Total depth 6,502 ft.; showing salt water; plugged to 6,400 ft.
Mission Drilling Co.'s No. 2 J. J. O'Brien, Refugio town tract, 150 ft. from E line and 150 ft. from S line 12½-acre tract ..... Drlg. shale and boulders 350 ft.
Moody-Seagraves Prod. Co.'s No. 3 O'Connor (D.D.), Refugio Town tract, 1,700 ft. from W line and 150 ft. from N line tract ..... Coring sand showing oil 6,440 ft.
Moody-Seagraves Prod. Co.'s No. 6 Morgan-O'Connor .... Total depth 6,470 ft.; sidetracked to sand showing oil 6,416 ft.; cem. 4½-in. casing 6,405 ft.
Moody-Seagraves Prod. Co.'s No. 8 O'Connor, Refugio town tract, 350 ft. east of No. 1 and 150 ft. from S line of lease ..... Oil sand 6,423-48 ft.; comp. flowing 26 bbls. hourly, 1,500 lbs. pressure, ¼-in. choke.
Moody-Seagraves Prod. Co.'s No. 2-A J. F. B. Heard ... Rig standing.
Pearson Properties' No. 5 Ryals, 174 ft. from S line of lease and 475 ft. E of No. 3 ..... Broken lime 1,880 ft.; milling on bit.
Ed Price's No. 3 Mission River, Refugio town tract, 750 ft. up river from No. 2 on S bank of river ..... Shut down 350 ft.
United Prod. Corp.'s No. 6 O'Brien, 150 ft. from S line of tract, 350 ft. W No. 3 ..... Drlg. broken shale 3,602 ft.
United Prod. Corp.'s No. 4 Power, S Blk. 33, Refugio townsite ..... Sand showing oil 6,450-58 ft.; cmtd. 7-in. csg. 6,448 ft.; set 18 ft. 5-in. screen; comp. flowing 300 bbls. pipe line oil, 1,900 lbs. pressure on casing and 1,850 lbs. on tubing, ¼-in. chokes.
United Prod. Corp.'s No. 3 Mitchell, 150 ft. from N line and 609 ft. from W line of tract ..... Total depth 6,458 ft.; plugged to 6,425 ft.; to perforate 5 3/16-in. casing in sand 6,411-21 ft.

Photograph shows installation of sectional type Key Fittings at the refineries of the Pennzoil Refining Company, Oil City, Pa.

Key Return Bends Speed Up The Dollar Stream

THE surging, pulsating flow of hot oil through refinery stills should mean but one thing to the refiner—*profit*.

Key Fittings and Return Bends speed up the dollar stream by increasing production and minimizing idle hours.

Since the early days of tube still construction, Key Fittings have been designed for every existing type of equipment and for all of the many operating temperatures and pressures.

Key Engineers have spent days and weeks in experiment and study to reduce to a minimum the time required for cleaning, stripping and heading. With refiners the world over using Key Equipment, their work has undoubtedly been successful.

• • •

ANY problems concerning operating conditions in specific plants will be answered, for field service engineers are available and ready to confer at any time. A letter, wire or phone call to the address nearest your plant will start us to thinking about your problems.

Multiple ring joint type. Illustration shows how tube end pieces are threaded on inside for reception of tubes, and threaded on outside to screw into shackles. Also note special interlocking device which holds the assembly in place under the most extreme operating conditions.

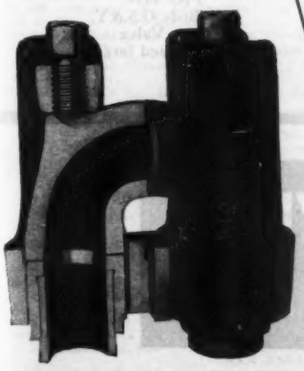

Illustration below is Key Fitting K3600, showing tapered joint principle and serrations for rolled-in tubes. This fitting and the one to the left are regularly supplied with forged steel shackles and cast steel U-Bends, but can be furnished with forged steel U-Bends when so specified.

KEY

BOILER EQUIPMENT CO.

East St. Louis, Illinois

1237 Chrysler Bldg. NEW YORK, N. Y.

733 Mayo Bldg. TULSA, OKLA.

2814 Santa Fe Avenue LOS ANGELES, CALIF.

PIPE LINE VALVES

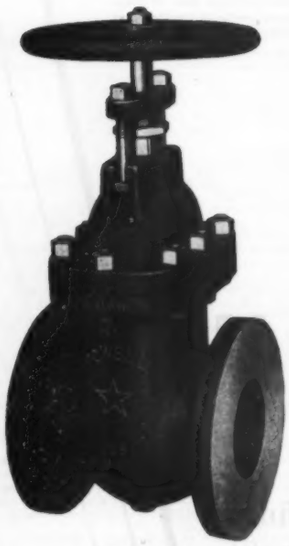

FIG. 1431
Iron Body N.R.S.
Gate Valve

FIG. 1444
Iron Body O.S.&Y.
Gate Valve

In mile after mile of pipe lines, Powell Valves have demonstrated their dependability. They are designed and carefully made to be oil and gas tight. To prolong their serviceable life, the renewable seat and disc construction allows these parts to be replaced without removing the valve from the pipe line.

Use Powell Valves for pipe line service and enjoy that continuous satisfactory service that will let you forget a valve after it has been installed. Let Powell Valves protect your pipe line investment!

Powell products include bronze, iron, steel, and corrosion resistant globe, angle, check, gate, and safety valves; also oilers, lubricators, grease cups, water and oil gauges, and other equipment for oil country service.

THE WM. POWELL CO.
2521-31 SPRING GROVE AVENUE
CINCINNATI, OHIO

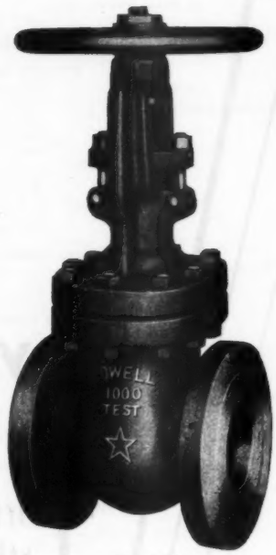

FIG. 2446
Iron Body O.S.&Y.
1000 Pound Test Gate Valve

FIG 1444
Iron Body O.S.&Y.
Gate Valve
Sizes 12" and larger.

POWELL VALVES

United Prod. Corp.'s No. 6 A. W. J. Heard, Refugio town tract, 1,253.6 ft. from W line and 257 ft. from S line of tract ..... Formerly comp. in sand 3,665-72 ft.; deepened to 3,715 ft.; plugged to 3,674 ft.; comp. 35 bbls., 750 lbs. pressure, ⅝-in. choke.

United Production Corp.'s No. 5 Holmes Heard, 660 ft. from N line and 2,375 ft. from W line Blk 8, town tract ..... Rig.

SOUTH LOUISIANA FIELDS

LOCKPORT—CALCASIEU PARISH

Vacuum Oil Co.'s No. 7 State, 319 ft. N and 260 ft. W SE cor. NE Sec. 8-10s-9w ..... Sand showing oil 6,628 ft.; cem. 7-in. casing and 1 joint screen.

Vacuum Oil Co.'s No. 5-A Farquahar, 105 ft. S and 110 ft. E of NW cor. SW NE Sec. 8-10s-9w ..... Derrick.

Yount Lee Oil Co.'s No. 2 Miller, 125 ft. N and 120 ft. W SE cor. NE NW Sec. 8-10s-9w ..... Drlg. shale 6,410 ft.

EDGERLY—CALCASIEU PARISH

Rex Pet. Co.'s No. 2 Prairie Narroni, Sec. 21-9s-11w, 365 ft. from S line and 50 ft. from E line of lease ..... Total depth 4,143 ft. in salt; sidetracked 3,890-4,000 ft.; drill stem stuck.

HACKBERRY—CAMERON PARISH

R. E. Seiss' No. 2 J. M. Vincent ..... Total depth in rock 2,042 ft.; sidetracked 970 ft. and drlg. 1,500 ft.

The Texas Company's No. 8 State ..... Derrick.

Yount Lee Oil Co.'s No. 34 State ..... Location.

Yount Lee Oil Co.'s No. 36 State ..... Location.

Yount Lee Oil Co.'s No. 37 State ..... Location.

Yount Lee Oil Co.'s No. 38 State ..... Location.

Yount Lee Oil Co.'s No. 39 State ..... Location.

VINTON—CALCASIEU PARISH

Marrs McLean's No. 11 Gray (D.D.), Sec. 33-10s-12w .... Drlg. out B.P.V. 1,869 ft.; to deepen.

Vinton Pet. Co.'s (Lucky Ten), No. 1 Lizzo ..... Aband. in heaving shale 3,600 ft.

SWEET LAKE—CAMERON PARISH

Magnolia Pet. Co.'s No. 2 Sweet Lake, Sec. 5-13s-7w .... Cleaning up after fire; total depth 4,876 ft.

STARKS—CALCASIEU PARISH

Gulf Ref. Co.'s No. 27 Lutcher-Moore, Sec. 19-9s-12w .... Tested salt water 1,268 ft.

SULPHUR—CALCASIEU PARISH

Union Sulphur Co.'s No. 762 (workover) ..... Salt 5,864-9,250 ft.; plugged to sand 4,964 ft.; sidetracked to sand 5,064-72 ft.; comp. flowing 1,400 bbls., ½-in. choke.

Union Sulphur Co.'s No. 765 fee, Sec. 29-9s-10w ..... No report.

Union Sulphur Co.'s No. 767 fee, 328 ft. E and 180 ft. N of C Sec. 29-9s-10w ..... Drlg. gumbo 1,620 ft.

MISCELLANEOUS WILDCATS

TEXAS

AUSTIN COUNTY

Empire Gas & Fuel Co.'s No. 1 Kuntze, San Felipe ..... Aband. 7,215 ft.

O'Hara et al's No. 1 Schrader ..... Fishing 3,920 ft.

Parmerson & Cafferkey et al's No. 1 W. M. Schlecte, John Fitzgibbons Sur., 1,850 ft. from SE line and 3,100 ft. from NE line of survey ..... Changing rigs 1,107 ft.

BRAZORIA COUNTY

The Texas Company's No. 1 Belcher, Manvel, 167 ft. SE of NW line and 223 ft. NE of SW line, Lot 18, Blk. A, Suburban Gardens Subd. ..... Drlg. gumbo 1,094 ft.

United Oil Syndicate's No. 1 Speer, A. A. Talmadge Sur... Set 48 ft. 4½-in. screen 1,866 ft.; bailed salt water.

BURLESON COUNTY

Mid-South Oil Co.'s No. 1 Duckworth ..... Shut down 2,646 ft.

Reynolds Oil Co.'s No. 1 Harris, 500 ft. from W line and 400 ft. from N line of J. M. McKean Sur. ..... Shut down 400 ft.

CALHOUN COUNTY

The Texas Company's No. 1 Smith, J. Timmins Sur., Will Mousin and Driscoll Subd. ..... Drlg. sand and shale 5,621 ft.

COLORADO COUNTY

United North & South Oil Co.'s No. 1 H. P. Lockwood, 3,100 ft. S line and 2,000 ft. W line J. R. Johnson Sur. ..... Drlg. shale 5,330 ft.

FORT BEND COUNTY

H. R. Cullen's No. 1 Lockwood, Clear Lake, John Rabb Sur., 300 ft. out of SW cor. 383-acre tract ..... Spudded.

GRIMES COUNTY

Rianjo Oil Co.'s No. 2 Cuthrell, Pat B. O'Connor Sur., center of 110-ac. tract ..... Derrick.

HARDIN COUNTY

Plummer & McDaniel's No. 1 T. S. Reed, 2,500 ft. from W line and 500 ft. from N line of T.&N.O. Sur. No. 296 ..... Cem. 12½-in. casing 194 ft.

HARRIS COUNTY

Hattie Baldwin's No. 1 Krahn, 250 ft. out of NW cor. L. Finn Sur. ..... Shut down in sand and gravel 209 ft.

Cypress Oil & Dev. Co.'s No. 1 C. Fritz, 500 ft. from N line and 500 ft. from E line of J. Duckworth Sur..... Sulphur water sand 451 ft.; cmtd. 8-in. casing; standing.

Humble Oil & Ref. Co.'s No. 5 Minnetex, Mykawa, 150 ft. from S line and 200 ft. from W line, Lot 261, William Lovett Sur. ..... Location.

Humble Oil & Ref. Co.'s No. 6 Minnetex, Mykawa, William Lovett Sur., C of Lot 254 ..... Sandy shale 5,018 ft.; reaming.

JACKSON COUNTY

Chicago-Gulf Co.'s No. 1 Rogers (workover) ..... No report.

JEFFERSON COUNTY

Humble Oil & Ref. Co.'s No. 1 McFadden, T.&N.O. Sur. 234 ..... Dry and aband. 7,663 ft.

The Texas Company's No. 4 Pipkin, Big Hill ..... Aband in heaving shale 5,970 ft.

LIBERTY COUNTY

Hamm et al's No. 1 Harvard, Davis Hill ..... Gumbo 1,015 ft.; shut down.

Tucker et al's No. 1 Bell, H.&T.C. Sur. No. 4 ..... Gumbo 560 ft.; shut down.

MATAGORDA COUNTY

H. C. Cockburn's No. 3 Hawkins, Shepherds Mott, 4,810 ft. SE along SW line of Farnum Fry Sur., thence 242 ft. NE at right angles ..... Drlg. rock 3,512 ft.

Empire Gas & Fuel Co.'s No. 1 Baker, Citrus Grove' ..... Heaving shale 6,413 ft.

MONTGOMERY COUNTY

Mike Hogg's (Lake Creek Oil Co.'s) No. 1 Hunt, south of Conroe ..... Drlg. water sand 3,219 ft.

H. W. Lowrie, Jr.'s No. 1 Groggan (G. J. Sunday), Cyrus Wickerson Sur. ..... Drlg. gumbo 2,504 ft.

Price & Wilhite's No. 2 Juerges ..... Drlg. shale 4,251 ft.

ORANGE COUNTY

Altex Oil Co.'s (Veteran Oil Co.) No. 1 Reed, A. Nelson Sur. No. 1, 500 ft. from N line and 250 ft. from E line of tract ..... Formerly temporarily abnd. 4,603 ft.; sidetracked hole 1,200 ft.; drilled to 1,820 ft.; shut down.

Crew Oil Co.'s No. 1-A Mansfield, 50 ft. E of No. 1 ..... Drlg. 550 ft.

POLK COUNTY

Freeman et al's No. 2 Freeman ..... Drlg. sandy shale 3,124 ft.

REFUGIO COUNTY

Blanco Creek Oil Co.'s No. 1 Damaan, 150 ft. from N line and 150 ft. from W line of Blk. 16, Bonnie View Ranch Subd. ..... Shut down for repairs 4,170 ft.

Rumble Oil & Ref. Co.'s No. 1 O'Connor, John Keating Sur., 6,012 ft. S from NE cor. along SE line of Lon T. Rios Sur., thence 7,375 ft. W at right angles in John Keating Sur. ..... Location.

SAN JACINTO COUNTY

E. P. Edward et al's No. 1 Bennett, northwest of Cold Springs ..... Spudded and shut down.

TYLER COUNTY

King Oil Co.'s No. 1 Caswell ..... Sand and shale showing oil 1,255 ft.; cmtd. 6-in. csg. 1,218 ft.

Allied Pet. Co.'s (Texas Southern Pet. Co.'s) No. 3 Wilson, Mrs. E. Cherry Sur. No. 798, 1,500 varas from W line and 600 varas from N line ..... Shut down 4,900 ft.

Lew Wentz' No. 1 Mann, James Seals Sur., 330 ft. out of SW cor. 804.25-ac. tract ..... Drlg. 500 ft.

VICTORIA COUNTY

Houston Oil Co.'s No. 1 Conrad, T.&N.O. Sur. No. 1, 1,100 ft. from SW line and 100 ft. from NW line .... Drlg. sand 525 ft.

Simpson-Fell and Westheimer et al's No. 1 Levi, 2,200 ft. from SW line and 2,000 ft. from NW line of S.A.&M.G. Sur. No. 4 ..... Tested salt water in sand 3,847-52 ft.

T. B. Slick estate's No. 1 McFaddin, J. Vairan Sur., 17,700 ft. NE along SE line from S cor. of survey and thence 5,050 ft. NW at right angles ..... Sand showing gas 3,502-12 ft.; cem. 8⅝-in. casing 3,495 ft.

The Texas Company's No. 3 McFaddin, S 15° W 6,200 ft. and N 75° W 1,850 ft. out of NE cor. John M. Rine Sur. ..... Moving in.

United Prod. Corp.'s No. 4-A McFaddin, M. Traviesa Sur., 1,320 ft. W along N line of C. L. Mann Sur. from NE cor. and 1,980 ft. N at right angles ..... Drlg. sticky shale 1,642 ft.

WASHINGTON COUNTY

Joe Baker et al's No. 1 Kramer, Brenham, 600 ft. S and 300 ft. W NE cor. 92 acres ..... Drlg. shale 1,982 ft.

Penn-Tex Oil Co.'s No. 2 Kamas Brenham, S. M. Williams Sur. ..... Sand showing 3,020-21 ft.; hung up 10-in. casing.

WHARTON COUNTY

H. H. Givens' No. 3 Hudgins, I. B. Phillips Sur., 19 ft. W of No. 2 ..... Drlg. limey shale 2,041 ft.

SOUTH LOUISIANA

BEAUREGARD PARISH

Beauregard Gas & Oil Co.'s No. 1 J. E. Cochran, 400 ft. S and 700 ft. W from NE cor., Sec. 34-4s-12w ..... Shut down 2,746 ft.

CALCASIEU PARISH

Crawford Doyle's No. 1 Johnson, Sec. 23-9s-13w ..... Shut down 875 ft.

J. O. Davis' No. 1 Industrial, Sec. 29-9s-10w ..... Set 6⅝-in. csg. with 172 ft.; 6⅝-in. screen on bottom 6.568 ft.; drilled plug and bailed dry; standing.

Wilfred Lahay's No. 1 Jardell, Sec. 16-10s-12w ..... Shut down 3,258 ft.

Dr. Thomas et al's No. 1 John Hewitt ..... Location.

Vacuum Oil Co.'s No. 1 Walt (D.D.), 225 ft. out of SE cor. Sec. 12-9s-7w ..... Drlg. water sand 6,380 ft.

CAMERON PARISH

Vacuum Oil Co.'s No. 2 Cameron Meadows, 3,120 ft. S and 1,900 ft. W from NE cor. Sec. 21-14s-9w (500 ft. S No. 1) ..... Drlg. gumbo and lime 4,194 ft.

The Texas Company's No. 7 State, Calcasieu Lake ..... Location.

IBERIA PARISH

Jefferson Lake Oil Co.'s No. 11 Lake Peigneur, Jefferson Island ..... Shut down 869 ft.

Jefferson Lake Oil Co.'s No. 12 Lake Peigneur, 3,100 ft. due W NE cor. Sec. 58-12s-5e ..... Drlg. hard sand 420 ft.

IBERVILLE PARISH

Standard Oil Co.'s No. 1 Gay, Bayou Choctou ..... Drlg. sand 4,322 ft.

Standard Oil Co.'s No. 7 Wilbert, Bayou Blue ..... Derrick.

Standard Oil Co.'s No. 6 Schwing, Bayou Blue, Sec. 73-9s-11e, 317 ft. S of No. 2 ..... Drlg. gumbo 965 ft.

Standard Oil Co.'s No. 7 Schwing, Bayou Blue, Sec. 74-9s-10w, N 45 degrees, W 1,800 ft. from No. 5 .... Drlg. 250 ft.

Standard Oil Co.'s No. 9 Wilbert, Bayou Des Glaise, 700 ft. E and 760 ft. N of SW cor. SE SW Sec. 78-8s-8e.. Drlg. sandy lime 3,760 ft.

PLAQUEMINES PARISH

Humble Oil & Ref. Co.'s No. 4 Cockrell-Moran, Sec. 14-20s-26e, 1,905 ft. S and 2,860 ft. E of station ..... Drlg. sand and shale 509 ft.

TERREBONNE PARISH

The Texas Company's No. 6 State, Caillou Island ..... Total depth 4,486 ft.; fishing.

The Texas Company's No. 1 La.L.&E., Bay St. Elaine .... Drlg. sandy lime 5,030 ft.

The Texas Company's No. 4 State, Dog Lake ..... Drlg. shale 4,469 ft.

The Texas Company's No. 3 La.L.&E., Bay Junop ..... Location.

The Texas Company's No. 4 La.L.&E., Bay Junop ..... Location.

The Texas Company's No. 6 State, Lake Barre ..... Drlg. hard lime 3,626 ft.

The Texas Company's No. 10 State, Lake Barre ..... Location.

The Texas Company's No. 11 State, Lake Barre ..... Driving piling.

The Texas Company's No. 12 State, Lake Barre ..... Location.

The Texas Company's No. 13 State, Lake Barre ..... Drlg. gumbo 3,241 ft.

The Texas Company's No. 14 State, Lake Barre ..... Location.

VERMILLION PARISH

Pure Oil Co.'s No. 1 Alliance Land, Sec. 34-11s-1w, 2,600 ft. N and 300 ft. E of SW cor. section ..... Drlg. sand 3,159 ft.

WEST FELICIANA PARISH

Putnam Syndicate's No. 2 Como Plantation, Sec. 51-1s-4w. Reaming 1,498 ft.

WILDCAT OPERATIONS IN KANSAS

(Continued from Page 32)

RICE COUNTY

Solar Oil Co.'s No. 1 Zink, SE NW Sec. 3-19-10w ..... Rig.

Detrick & Langston's No. 1 Purcell, NW cor. Sec. 33-19-9w ..... Drlg. 1,300 ft.

McFadden and Shell's No. 1 Jennings, SW NE NW Sec. 29-18-6w ..... T. D. 1,450 ft.; plugging back to 1,130 ft.

Cress et al's No. 1 Sharp, SE NE Sec. 13-20-10w ..... Show oil 3,107-15 ft.; Silicious 3,-330-36 ft.; estimated 1,500 bbls.; shut in.

Allison-Fitzwilliams' No. 1 Blake, NE NW Sec. 9-18-10w. Rig.

RENO COUNTY

Shell Continental's No. 1 Blake, SW SE SE Sec. 23-23-4w. Chat 3,267-3,308 ft.; 8,500,000 ft. gas; shut in.

ROOKS COUNTY

Empire Oil & Ref. Co.'s No. 1 Halsman, SW NE SE Sec. 17-7-20w ..... Drlg. 3,302 ft.

RUSH COUNTY

Dewey & Mitchell's No. 1 Greenawalt, C SW Sec. 17-19-16w ..... Drlg. 3,190 ft.

RUSSELL COUNTY

Hall et al's No. 1 Mills, SE SW SE Sec. 30-14-13w ..... Show oil 2,902-08 ft.; drlg. deeper at 3,046 ft.

Agate Oil & Gas Co.'s No. 1 Rochfellow, SE cor. Sec. 6-13-12w ..... Shut down 3,374 ft.

Gilbreath et al's No. 1 Bratton, C NE Sec. 33-11-13w .... Show oil 3,090-94 ft.; shut down.

SEDGWICK COUNTY

Buck et al's No. 1 McNananan, NE NW NW, Sec. 2-29-1. Shut down 2,440 ft.

SALINE COUNTY

Stanolind Oil & Gas Co.'s No. 1 Martin Com., NE SE SE Sec. 3-16-3w ..... Drlg. 3,299 ft.; show oil.

Twin Mounds Oil Co.'s No. 1 Weis, C W half NE NW Sec. 20-13-4w ..... Shut down 2,700 ft.

SHERIDAN COUNTY

Flo et al's No. 1 Shoemaker, SE SW SW Sec. 27-7-26w.. Shut down 1,610 ft.

STAFFORD COUNTY

Rosenthal, Stanolind and Amerada's No. 1 Gray, C NE Sec. 11-24-13w ..... Fishing 2,201 ft.

STEVENS COUNTY

Argus Prod.'s No. 2 Christopher, C NE Sec. 10-33-39w .. Drlg. 5,420 ft.

SUMNER COUNTY

Spencer et al's No. 1 Porter, NE SW Sec. 12-33-4w ..... Rig.

Olstot et al's No. 2 Marlow, C SE NW SE Sec. 22-33-3w.. Drlg. 1,740 ft.

WASHINGTON COUNTY

Sincox et al's No. 1 Penwell, NW SE NE Sec. 16-3-3 .... Shut down 1,720 ft.

TELLS TEXANS THEY CANNOT MAKE MONEY

(Continued from Page 44)

cents and you have $6,562.60. Cost at the most conservative figure has already been $8,500, leaving the producer about $2,000 in the hole on his first 100,000 bbls. of production.

"Then you might say the operator is ready to make money on his second 100,000 bbls. But by this time this well will have to go on the pump, if not before. So he starts out with a $2,000 minimum deficit on his second 100,000, but must install pumping equipment to begin work. Pumping equipment, rods, units, etc., will cost him at least $2,000. This makes a deficit of $4,000 he starts out under on his second 100,000 bbls.

"When the second 100,000 is run on a pumper, he may have made $2,000 by these figures, which includes every cut to be made, such as second-hand casing and the like. The average cost of pumping oil at the depth in this field is 25 cents a barrel, including machinery set up for pumping. It cannot be done, and that is what the field is facing today.

"I took the 10-acre lease and based production on an assumed total yield of 30,000 bbls. per acre, which means ultimate production of 300,000 bbls. from the lease. I have showed how the producer will come out on the first 200,000 bbls. You can figure how much it will make on the third 100,000 bbls. at 20 cents when it costs him 25 cents to lift it.

"Contrast a 20-cent price with the former posted prices of 63 to 67 cents and figure the thing out all over again. One can readily see the difference, by doubling or tripling the price back to where it was. It makes no difference how much they bootleg, they cannot make money at 20 cents a barrel in this field, to say nothing of exhausting their production by flush runs.

"Some system must come into this field. East Texas will soon have about 600 oil wells. Each one on an average good for 6,000 bbls. daily production if the whole field were opened wide and pressure equally divided. That gives us 3,600,000 per day daily potential for the field—more than enough crude to meet the entire world demand.

"What are people going to do about it?"

GULF COAST FIELDS

(Continued from Page 36)

only, cannot be sold at current prices in competition with other more desirable gasoline crudes which are available to our customers at lower prices. We are hopeful that this readjustment of the price schedule will enable us to sell the oil we purchase and continue as purchasers in the field."

The Lockport revision is particularly significant in that it apparently is a step toward the return to the original basis of coastal crude prices, that of the lubricating oil content value. Formerly the bulk of coastal oil was of heavy gravity with large lub content. More recent development has resulted in the uncovering of higher and higher gravity oils with a corresponding increase in gasoline content and other lighter ends, which brought about the placing of light Grade B oil on a gravity price scale comparative to Mid-Continent and other gasoline content crudes. For a time a price scale was carried to as high as 44 and above gravity oil but recent months have seen a deciding narrowing of price ranges. The disadvantage of coastal oils for gasoline value, however, lies in the fact that the light end content is proportionately not as great as in other crudes, and in periods as at present, when gasoline crudes are in abundance and at low prices, coastal oils cannot compete for their gasoline value and can only be judged upon their lubricant value.

Whether other coastal buyers will adopt Vacuum's policy as applied to other fields remains to be seen, but there is no denying that the flush East Texas district has proved a very material bearish factor in the coastal light oil market, although the latter oil is comparatively tight.

CALIFORNIA FIELDS

(Continued from Page 44)

No. 49, a deep test in the Lost Hills Field of Kern County at 5,515 feet. Further coring will be done and pipe will be landed if the formation for the next 100 feet continues favorable. George F. Getty cored ahead in No. 1-A Lincoln Drilling to 4,077 feet and a string of 8⅝-inch pipe has just been landed. If a satisfactory water shutoff is secured this hole, located in the northwestern part of the Lost Hills will be drilled ahead. The Belridge Oil Co. picked up the top of the Temblor in its well No. 8 in the North Belridge Field of Kern County at 4,917 feet and a 10¾-inch water string has accordingly been landed and cemented at 4,915 feet. This well is structurally higher than any other drilled in the North Belridge Field up to the present time. The Reward Oil Co., a subsidiary of the Associated, is rotating ahead in a rich oil sand in its well No. 4 in Section 34-27-20 at 5,475 feet, and this project should be listed for early completion.

The General Petroleum added a new well to its list of producers on the Heisen lease in the Mount Poso Field of Kern County when well No. 34 was brought in pumping 202 bbls. of 16.9 gravity oil per day from 1,783 feet, the hole having been finished with an 8⅝-inch liner carrying 68 feet of perforated. The Golden Bear Oil Co. has completed arrangements for the laying of a 6-inch pipe line from the company's property at Round Mountain to a loading terminal approximately 10 miles away. A five-car loading rack will be erected and 15,000 bbls. of steel tanks constructed at the same time. The Chanslor-Canfield Midway Oil Co. is putting the finishing touches on No. 2 Mon, a new well in this area, and the crew will be shifted to No. 3 Poso which will be spudded in upon the completion of work now under way.

Ventura Avenue

The Associated completed a new well in the Ventura Avenue Field during the past week when No. 10 McGonigle was brought in doing 376 bbls. of clean 28.1 gravity oil and 520,000 feet of natural gas per day from 6,875 feet. This well failed to result in a natural flow and the company was obliged to install a compressor. Drilling operations in the Ventura Avenue Field have reached their lowest level in several years although both the Associated and Shell are making preparations to increase the present scope of work. The General Petroleum recently killed No. 2 Needham on tideland permit No. 55 in the Rincon Field of Ventura County and is coring ahead in order to determine the possibility of developing better production below the sand in which this well was recently completed. No. 3 Ferguson, another tideland project which the General Petroleum is drilling in this field, encountered a strong gas pocket at 1,238 feet and considerable difficulty was experienced in mudding off the gas. Another new well was spudded in on the Santa Barbara Mesa during the past week and two additional locations have been staked. The new well started was Charles Starke's No. 1 Nye.

CANADIAN FIELDS

(Continued from Page 39)

18-2w5; Structure Oil & Gas' No. 3, LSD 13, Section 34-18-2w5; and Van. Pacific's No. 1, LSD 24, Section 22-18-2w5. In the immediate vicinity of the Merland well, acreage is held by British Oil & Development Corp., Madison Oils, Ltd., and Richfield Petroleums, Ltd., which is now completing a deep lime producer in the north central area and is planning to drill its No. 3 in the Merland area.

Imperial Drilling

Among the Imperial tests in South Turner Valley, Mayland Oil Co.'s No. 6, Section 17-19-2w5, is reported on steady production from the lime at 4,935 feet, and making between 250 and 290 bbls. Lowery Petroleums' No. 2, NW same section, was shot 363 feet in the lime at 6,433-foot depth with 500 quarts and is cleaning out and testing.

On the west flank, South West Petroleums' No. 2, Section 8-19-2w5, is drilling at 5,310 feet. A producer at this point would materially extend the proven field.

May Deepen Old Producer

It is reported that Royalite Oil Co.'s No. 4, LSD 4, Section 7-20-2w5, will be deepened and a standard outfit is rigging up. Royalite's No. 4, famous as the "Royalite gusher" and for more than a year the only deep lime producer in the field, was the first well to get production in the Madison. Since October, 1929, its production has been small and fluctuating. It got the lime at a rather high point in the central field, and got production only a short distance in the lime, so that the possibilities of the lower lime were never fully tested.

South Turner Valley

In the South Turner Valley, East Crest Oil Co.'s No. 3, LSD 4, Section 16-19-2w5, which got production in the lime at 4,843 feet, is still cleaning itself out. It reported an initial wet gas flow of 20,000,000 feet with 160 bbls. estimated crude naphtha recovery; it was later shot and has made up to 168 or 170 bbls. without affecting the production of the other East Crest wells. No. 2-A is reported making around 300 bbls. and No. 1 about 30 bbls. The latter will be cleaned out and possibly deepened. No new drilling is contemplated until the present wells have paid for themselves.

Mercury Oils' No. 1, LSD 12, Section 4-19-2w5, is maintaining its position as the largest Turner Valley producer, making around 500 bbls.

Central Turner Valley

In the Central Turner Valley, British Dominion Oil & Development Corp.'s No. 3, LSD 6, Section 12-20-3w5, is testing production following a shot at 5,542 feet. It looks like a fair producer. British Dominion's No. 2, same LSD, which has has been making around 40 bbls., is being cleaned out and deepened from 5,187 feet, a lower porous horizon being expected at around 5,230 feet. In LSD 44, same section, New Illinois-Alberta Oils' No. 1, which got only about 15 bbls. following a shot in the lime at 3,890 feet is drilling deeper.

Dome Oils' No. 2, LSD 16, Section 36-19-3w5, is cementing 6⅝-inch casing in the lime at 5,173 feet after getting the contact at 5,165 feet. The test got about 1,000,000 feet of gas in the top of the lime.

North Central Area

In the north end of the central field, Richfield Petroleums' No. 2, LSD 12-13, Section 13-20-3w5, is reported at 5,070 feet and cleaning out after a shot. The well had a fair wet gas flow from two horizons, which has apparently been somewhat increased. Spooner Oils' No. 2, LSD 14, same section, whose production has declined to about 30 bbls., is being shot.

Okalta Operations

Shareholders of Okalta Oils, Ltd., held their annual meeting last week in Calgary when the following directors were re-elected: John I. McFarland, W. S. Herron, James W. Davidson, E. L. Harvie, R. W. Ward, H. K. Reed, L. H. Fenerty, T. M. Carlyle, P. S. Woodhall. Reports showed that Okalta's No. 1, LSD 1, Section 1-20-3w5, had been recased and put in good shape, tests of production under the new conditions being still in progress. No. 2 is making 30 bbls. and No. 3 making 20 bbls. from the deep lime. Nos. 4 and 5 will be left standing around 1,600 feet.

Mid-West Drilling Project

Shareholders of Mid-West Oil Co. of Calgary are to be asked to approve a reorganization as a preliminary to actual development work on the company's holdings in the Turner Valley. It is proposed to form a new company, the Mid-West Petroleum Corp. At the same time, an agreement whereby Imperial Oil, Ltd., will drill a well for the new company will be considered.

Alberta Production Report

The provincial department of lands and mines has issued official figures covering actual production of all Alberta fields for April, showing a production for Turner Valley of 134,159 bbls. of crude naphtha and light crude, of which 114,217 bbls. were handled by the pipe lines and 19,942 bbls. sold direct at the wells. This total represents an increase of 45,460 bbls. over the production for April, 1930. Detailed figures follow:

Field—	April, 1931	4 mos., 1931
Turner Valley naphtha	132,533	569,598
Turner Valley light crude..	1,626	8,196
Red Coulee light crude	6,809	24,445
Wainwright heavy crude ..	1,306	3,123
Ribstone heavy crude	270	1,395
Total	142,544	606,760

Red Coulee production in April, 1930, was 2,773 bbls. Wainwright showed an increase of about 400 bbls. over the same month last year; the production for the entire province of 142,544 bbls. comparing with 92,404 bbls. in April, 1930.

Border Gas Field

In southern Alberta, east of Coutts, Mayland Southern's No. 1, wildcat, LSD 13, Section 4-1-9w4, is drilling below 900 feet with a reported gas flow of around 4,000,000 feet. An initial flow of 2,000,000 feet was encountered at 310 feet and a further 2,000,000 feet was reported at 700 feet. Location is on an Alberta extension of the Reserve Dome, one of the structures of the Sweetgrass Hills area in Montana. The Reserve Dome is immediately west of the Flat Coulee Field in Montana and extends across the Alberta boundary. The northern slope of the structure, known as the Dawson terrace, is being tested by Mayland Southern's No. 1.

Border Drilling

On the Spring Coulee structure, Alberta Pacific Consolidated's No. 1, LSD 12, Section 15-4-23w4, has been plugged back to 6,118 feet after encountering sulphur water at 6,191 feet. In addition to the water, the well showed considerable gas under heavy pressure, and casing will be cemented preparatory to testing production.

In the Taber district, Alberta Pacific Consolidated's No. 1 Cole-Hunter, LSD 3, Section 11-10-17w4, is below the old bottom at 3,327 feet and is preparing to test an 11-foot oil sand. It is unofficially reported the show was met just above the Madison contact.

In the Keho Lake area, Hudson's Bay Oil Co.'s No. 1 Keho, LSD 2, Section 17-11-22w4, is making new hole at 3,966 feet after drilling up a lost plug.

Paintearth Test

In the Castor area, Hudson's Bay's No. 1 Paintearth, LSD 5, Section 27-39-15w4, is cementing 6⅝-inch casing for water shutoff at 4,275 feet. The test has been drilling in the limestone with a lot of salt water in the hole, and is the only test in that section to get into the lime horizon.

Red Coulee Field

On the Alberta end of the Red Coulee structure, Southern Alberta Exploration Co.'s No. 2, Section 3-1-16w4, got the Vanalta sand at 2,370 feet with initial gas flow of 1,000,000 feet. The test, only 440 feet east of No. 1, got the sand 45 feet higher with less gas. After drilling into the sand, a production test was made at 2,401 feet, showing about 15 bbls. compared with around 60 bbls. from No. 1. Drilling will be continued to the Cosmos sand, underlying the Vanalta.

On the Montana end, Askalta Oils, Ltd., of Calgary, has obtained an interest in the Cosmos Petroleum Co. lease and is starting a drilling program of four wells, the first to be a direct offset to Cosmos' No. 1 producer. No. 1 is reported rigging up.

Parco Test

Announcement has been made that the new test by Parco Oil Co. in southern Alberta will be in the nature of a joint test with Nordon Corp. Location is given as LSD 11, Section 34-1-20w4, 15 miles west of Dalco Oil & Gas Co.'s No. 2. Derrick is up and cable tools are being moved in. The location is east of Shank Lake and midway between the north and south branches of Milk River, and about 6 miles north of the Montana line. Both Parco Oil Co. and Nordon Corp. hold extensive acreage and considerable core-drilling preceded the location. This is the first deep test to be undertaken in the Shank Lake or Twin River area. Operations will be directed from offices at

Calgary, E. H. Aderton being in general charge.

Shareholders of South West Petroleums, Ltd., held their annual meeting at Toronto, when J. H. McLeod was re-elected president and Manning Doherty named director in place of W. G. Steadman, deceased. Other officers were re-elected.

East Central Alberta

In the Ribstone Field, East Central Alberta, Commonwealth-Algonquin's No. 2, LSD 5, Section 16-45-1w4, is reported spudding in.

In the Wainwright Field, Montreal-Alberta Oil Co.'s No. 1 near Wainwright is rigged up. Drilling equipment from Edalta Oils' No. 1 is being moved in for the test.

Alberta Regulations Discussed

Representatives of the Alberta oil operators held two conferences last week with members of the provincial government at Edmonton in reference to the new oil and gas regulations. The delegation included R. Van A. Mills, D. Austin Lane, R. J. Hutchings, J. H. McLeod, H. H. Greenfield, W. C. Fisher, A. G. Spooner, B. F. Hake, C. E. Snyder and R. S. Bird, and they were received by Premier Brownlee and Messrs. Reid, Hoadley, McPherson and Lymburn. The deputation urged restoration of the permit system, a more liberal application of drilling credits without restriction to any specific area, appeal to the courts instead of to the minister of lands and mines in regard to disputed points, reduction of rentals to 50 cents an acre, free use of any type of drilling equipment and free right to assign, transfer or sublet leases without permission of the mines department.

It was agreed that appeals in disputed matters should be handled by the Alberta Public Utilities Commission. The government reserved its decision on the other points.

British Columbia

In British Columbia, International Pipe Line's No. 3 on Lulu Island near Steveston has largely overcome the difficulty of sanding by the use of screen pipe. A test at 626 feet showed a smaller gas production than International's No. 2, which had gauged close to 500,000 feet. The 4½-inch pipe has been pulled and No. 3 will be deepened to 1,000 feet. In the same field, Altamont Oil Co. of Vancouver has camp buildings under construction and is moving in standard tools for its No. 1 test south of Steveston. The main gas sand is looked for at 2,700 feet.

In the Quesnel district, Frank Patrick Syndicate's No. 1 near Australian has finished a fishing job and is reported preparing for a test of a sand encountered around 800 feet. It is claimed the sand is 70 to 80 feet thick and showed 31.5 gravity crude, though apparently in small quantities. A blanket reserve for oil and natural gas was placed by the provincial government on the Cariboo district. The reserve will not affect oil claims properly staked in accordance with regulations and duly advertised before the order-in-council was issued but will prevent any further staking.

Manitoba Test

In southwestern Manitoba, Commonwealth Petroleums' No. 2, LSD 2, Section 26-2-9WPM, has spudded in and is drilling below 120 feet.

Ontario Drilling

In the Dawn Field, Lambton County, Ontario, Union Natural Gas Co.'s No. 58, SW, Lot 11, Concession 1, Dawn Township, finished dry at 2,188 feet. The outfit will be moved to Union's No. 49 which will be deepened. Union's No. 59, NW, Lot 24, Concession 2, encountered gas at 1,320 feet and a further flow at 1,380 feet, making an aggregate production of 120,000 feet. Below the gas, 120 feet of salt was drilled between 1,420 and 1,540 feet. At last reports the test was drilling at 1,575 feet.

In Haldimand County, Union Natural Gas Co.'s No. 194, Lot 22, Concession 7, Walpole Township, is drilling into production in the red Medina with an initial flow of 5,000 feet. Union's No. 200, SE, Lot 21, Concession 2, Walpole, is drilling on top of the Clinton sand with a small show of gas.

In Mosa Township, Middlesex County, Southern Ontario Gas Co.'s No. 8, SE, Lot 13, Concession 3, has about 170,000 feet of gas and has been shut in. It will be shot.

In Chatham-Gore, Kent County, near Wallaceburg, the Black Bear Syndicate of Detroit is reported to have made tentative locations for a series of eight tests.

KANSAS FIELDS

(Continued from Page 32)

and completed for 8 bbls. of oil and 1 bailer of water per hour. The well is shut in until a pipe line connection is obtained. The well opens a new producing area about 2 miles north of the Ochs Pool, in the same county which was found by the Empire Oil & Refining Co. in 1929.

4,000-Bbl. Well in Welch Pool

The largest well ever found in the Welch Pool in the southeastern part of Rice County is estimated at 4,000 bbls. a day, and was completed in the past week. Hipple & Rogers' No. 1 Rainey, NE cor. NW SE, Sec. 3-21-6w, was completed about six months ago for about 2,000 bbls. a day from the chat at 3,368-90 feet. The owners decided to drill the well deeper and it increased its flow to 183 bbls. an hour after being drilled 2 feet to a total depth of 3,392 feet. It was completed about six months ago and it extended the production in the field a half mile to the south. It is the largest well ever completed in the Welch Pool, its potential output based on the 183 bbls. per hour is 4,392 bbls. a day. The largest well previously completed in the pool was Independent Oil & Gas Co.'s No. 2 Miller, NW cor. NE NE, Section 3-20-6w, it making 1,200 bbls. a day and was completed in May, 1927.

Reno's Uncertain Depths

Operators are finding the Haury district in Reno County uncertain as to producing horizons. Tests drilled to date have revealed a difference in depth at which oil and gas are found, providing no uniform level at which to expect the pay. The discovery well of importance was the Empire Oil & Refining Co. and others' No. 1 Haury, NE cor. SW Section 1-23-4w, which made 25,000,000 feet of gas a day from a total depth of 3,333 feet. The next well completed in the area was the north offset, Lloyd, Frost, Study and Turner's No. 1 Haury, SE cor. NW Section 1-23-4w, which found 7,000,000 feet of gas and 360 bbls. of oil a day at a lower level in the chat. The McPherson Oil & Gas Co. then drilled the northeast offset to the discovery well and found 130 bbls. of oil and 3,000,000 feet of gas at 3,342-62 feet, which was still lower than the above wells.

The Derby Oil Co. and Reserve Petroleum Co. drilled a test about a quarter of the mile northeast of the discovery well, finding a little oil and some gas in the chat. After drilling deeper it found a showing of oil in the Viola lime and water and was drilling 3,802 feet.

Other tests drilling in the vicinity are Study and Turner's No. 1 Goering, SE cor. NE NW Section 1-23-4w, a quarter of a mile north of the discovery well; T. Palmer and Collingwood's No. 1 Gaering, NW cor. SE Section 1-23-4w, the east offset to the discovery well, and F. Hollow and others' No. 1 Acre, SW cor. NW Section 20-22-3w, a mile east of the Reno County line in Harvey. It is being drilled on a 1-acre lease.

Cowley County

H. R. Allen and others' No. 1 Bice, NE cor. SW, Section 29-30-6, has been abandoned at 3,532 feet.

Ellsworth County

Gilmore Oil Co.'s No. 1 Sturm, NW cor. SW, Section 31-17-9w, is dry and abandoned at 3,295 feet.

McPherson County

McPherson Oil & Gas Co. and Shell Petroleum Corp. made location for No. 3-B Meyers, C NE SE, Section 14-19-2w. Location was also made for No. 3 Giffin, C SE NW, Section 14-19-2w. Shawver and Shell Petroleum Corp.'s No. 1 Decker, NE cor., Section 2-20-2w, is moving in. Gypsy Oil Co.'s No. 3 Stuckey, SE cor. SW SE, Section 33-20-3w, is an old well drilling deeper at 3,295 feet. Phillips Petroleum Co.'s No. 2 Morehouse, NW cor., Section 3-21-3w, has been deepened from 3,448 feet to 3,497 feet in silicious lime and now shut down for orders. Ritz Oil & Gas Co. and Shell Petroleum Corp. made location for No. 1 Neufeldt, SW cor. NW, Section 15-21-3w. McPherson Oil & Gas Co. and Shell Petroleum Corp.'s No. 3 Decker, C SE NE, Section 11-19-2w, has been completed for 51,278,000 feet of gas in chat 2,889-2,939 feet. No. 3 Salthouse, C SE SE, Section 15-19-2w, made 3,478,000 feet of gas from chat 2,919-47 feet. Lario Oil Co. and Shell Petroleum Corp.'s No. 1 Suffield, SE cor., Section 25-19-2w, has been completed for 2,710 bbls. on swab, producing from Viola lime, 3,396-3,414 feet. No. 1 Lagree, NW cor., Section 31-19-1w, swabbed 1,750 bbls. in 12 hours from Viola lime, 3,409-20 feet. No. 2 Lagree, SE cor. NW, Section 31-19-1w, has been completed for 1,580 bbls. in 12 hours from Viola lime 3,393-3,403 feet.

Morris County

General Utilities Co.'s No. 1 Irwin, NE cor. SW SW, Section 15-17-7, is spudding. No. 1 Alexander, C NW NE, Section 22-17-2, is also spudding.

Reno County

Shell Petroleum Corp. and Continental Oil Co.'s No. 1 Blake, SW cor. SE SE, Section 23-23-4w, has been completed for 9,750,000 feet of gas in sand 3,266-3,308 feet.

Rice County

Rogers and others' No. 1 Walsten, NE cor., Section 9-21-6w, is a rig under construction. Muth Brothers and others' No. 1 Freeman, SE cor., Section 4-21-6w, has been completed for 60 bbls. in chat 3,430-60 feet.

Sedgwick County

Gypsy Oil Co.'s No. 3 Rose Hamant, SW cor. NW SW, Section 14-26-2, is rigging up to deepen from 3,205 feet. Shell Petroleum Corp.'s No. 3-A Lygrisse, SE cor. SW SW NE, Section 15-26-2, is moving in to deepen from 2,901 feet. Fisher & Lauck's No. 1 Sanders, NE cor. NW SW, Section 1-28-1e, is dry and abandoned at 3,458 feet.

Stevens County

Texas Interstate Pipe Line Co.'s No. 1 Johnson, C NW, Section 6-34-37w, made 6,000,000 feet of gas in sand 2,750-95 feet. Argus Production Co.'s No. 1 Greenwood, C NE, Section 11-34-38w, has been completed for 6,000,000 feet of gas in sand 2,675-2,802 feet.

SOUTHWEST TEXAS FIELDS

(Continued from Page 38)

the Slick Pool on the DeWitt-Goliad County line.

Balcones Fault Zone

R. R. Ogden failed to get a drill stem test of the Edwards lime at 2,330-38 feet in his No. 1 Alexander, southwest of the Dale Field in Caldwell County, and is arranging to set casing with a packer and test. It is about a mile northeast of Mills' No. 1 McMahon, which made a small well about the Edwards lime.

An Edwards lime wildcat faliure was chalked up in Milam County when Rheubotham's No. 1 W. T. Johnson, 2 miles south of Gabriel in the western part of the county, got sulphur water at 2,195 feet and was abandoned.

In the Chapman Pool in Williamson County there were two completions last week, both by Ertel and others. The No. 10 Abbott at 1,947 feet with top of serpentine at 1,640 feet made a 35-bbl. well, but the No. 11 Abbott at 1,932 feet with top of serpentine at 1,600 feet made a 950-bbl. well and one of the best in the field.

In northern Guadalupe County Harry Bruner's No. 1 Sherrill is down 678 feet and ratholing ahead for the sand. It is an attempt to pick up shallow production that has shown in a number of tests in that part of the county near Staples but which has never been developed. By the end of another week it will be known whether there is to be another pool opened or not.

In the western part of Guadalupe and getting closer to the Balcones fault where the Edwards is reached at shallow depth McGarrity and others are changing to a heavier rig at 800 feet. The Edwards was topped at 540 feet and the test is to be a Trinity test.

In Bexar County, continuing the happenings in the Balcones fault zone, Camp and others' No. 1 Chevas, 10 miles south of San Antonio, was below 2,400 feet and expecting most any minute to pick up the Edwards lime. It is one of the most important of the wildcat tests in all the country and is being drilled on a Humble block and on Humble geology, Camp having taken a half interest in the acreage for the test. In spite of plenty of good geology that has been responsible for many wildcat tests across the southern part of Bexar County, there is no Edwards lime production or any production deeper than the Taylor marl of Somerset in the county. Camp's No. 1 Chevas is about 2½ miles south and a little east of the Ren-Tex well on the Yturris tract in the Southton Field which drilled past the Edwards lime and recorded as a failure and abandoned but not plugged and which has been making a head of about 50 to 100 bbls. about four times a year but with uncertainty as to what depth the production is coming from.

Sunflower Oil Co. is likely to have something to report as to the Edwards lime in Medina County within a week. It topped the Georgetown at 1,959 feet late last week. It is the No. 1 Mofield and is about 3 miles due west of the Ina Field.

PITTSBURGH STEEL CO. FURNISHED DRILL PIPE

The Pittsburgh Steel Co. furnished the drill pipe which was used by the Union Sulphur Co. in drilling to 9,250 feet in its No. 762 Fee, located at Sulphur Dome, Calcasieu Parish, Louisiana. In a feature article on Page 143 of the May 14 issue of The Oil and Gas Journal, describing this drilling accomplishment, another company was given credit for furnishing the drill pipe.

The drilling was done with 3½-inch drill pipe and the string was made up of two different weights of pipe. Despite this fact, every foot of the pipe was recovered without trouble from the depth of 9,250 feet.

A.P.I. HONORED

The American Petroleum Institute received honorable mention for meritorious achievements during 1930 in connection with annual presentation of the American Trade Association award at the dinner of American Trade Association executives held recently at Atlantic City, N. J. The Institute was cited as follows: "The American Petroleum Institute, William R. Boyd, Jr., executive vice president, for its accomplishments through standardization and simplification, uniform accounting, technical research, statistics, and a trade practice code to which approximately 15,000 have subscribed, reducing many of the worst of their marketing troubles."

EAST PENN DEVELOPMENT CO.

NEW YORK, June 1.—East Penn Development Co. is a subsidiary of Pennsylvania Gas & Electric Corp. and neither its stock nor any of its gas acreage has been assigned, conveyed or transferred in any way to Lycoming Natural Gas Co. There has simply been a contract executed to sell gas to Lycoming. Allegany Gas Co. is a subsidiary of North Penn Gas Co., while North Penn Gas Co. and the Crystal City Gas Co. are both directly controlled by the Pennsylvania Gas & Electric Corp.

W. G. STEDMAN DIES

CHATHAM, Ontario, May 30.—Maj. W. G. Stedman, prominent for a number of years in Alberta oil operations, died last week at Calgary, age 44 years. Major Stedman was one of the directors of Southwest Petroleum, Ltd.

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WILL BUY APPROXIMATELY 50 miles of good used 5 or 6-inch line pipe. Might use 5⅛ or 6⅝-inch lapweld casing if in condition to use as line pipe. Give location, condition and price.
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WANTED TO BUY No. 2-A or 3 Steel National Drilling Machine complete. Must be in A-1 shape. Address Box 292, Duncan, Okla.

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FOR SALE: Good used seamless casing, line pipe, good used drill pipe, available at several places throughout the Mid-Continent Oil Fields.
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FOR SALE FOR LEASE
Four 10,000-gals. tank cars coiled. 50 ton trucks. Victor Car line, 111 West Jackson Blvd., Chicago, Ill.

FOR SALE for a low price. A gasoline powered Sullivan Diamond Core Drill. Write Box E-492, The Oil and Gas Journal, Tulsa, Okla.

FOR SALE: Are offering a limited amount of good used rotary equipment, cable tools of all kind, gas or oil pumping engines, boilers and all sizes of drill pipe. Available for immediate delivery at several points throughout the oil fields. It will pay you to figure with one of the Bridgeport Stores for this class of material.
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FOR SALE: 1 type 10, 165 H.P. Bessemer Compressor, 1—8x8 Clayton Twin Compressor, 1 25 H.P. Reid Gas Engine. All in A-1 shape. Nolan Sales Corp., 827 East First St., Tulsa, Okla.

FOR SALE—EQUIPMENT

FOR SALE — Slightly used Ingersoll-Rand steam two stage, 250-pound air compressor. Piston displacement. 312 cubic feet per minute at 200 r.p.m. Complete with intercooler and receiver. Write Box E-456, The Oil and Gas Journal, Tulsa, Okla.

BUSINESS OPPORTUNITIES

DEEDED MINERAL interest spread covers 6 tracts one under 5,000 barrel well in Rusk County new field. Write for map. ⅛ mineral rights 142 acres Bee County 1,200 feet from 450 barrel well $250.00 basis. 7,905.5 acres new 10 year paid up lease ¼ royalty same term Edwards County, Texas, in active line of play $1.25 acre. Stieren & Koenig, Alamo National Bldg., San Antonio, Texas.

WANT TURNKEY BID on 2,500-foot test well, eastern Nebraska. Petroleum Producers, Inc., 800 First National Bank, Omaha, Nebr.

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E. T. Marion Oil Properties,
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TULSA OKLAHOMA

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SALESMANAGER WITH $5,000, to join old New York brokerage house, build up oil royalty sales force and clientele, handling large transactions. References. Parmer and Company, 25 Broad St., New York, N. Y.

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I NEED A SALESMAN to sell Oklahoma oil royalties and land. My plan would place you in business for yourself. Write Box E-493, The Oil and Gas Journal, Tulsa, Okla.

MECHANICAL ENGINEER thoroughly trained in design of rotary rigs with long experience in office and shopwork wanted by European oil well supply works. In reply please give information concerning your personal history and details concerning your education and experience; send kodak picture of yourself; state salary expected and date available. Location Germany. Write Box E-498, The Oil and Gas Journal, Tulsa, Okla.

WANTED: Lubricating oil salesman acquainted with tank car jobbing trade. Drawing account and liberal commission. Address Box E-499, The Oil and Gas Journal, Tulsa, Okla.

TURN TO PAGE 269 FOR ADDITIONAL CLASSIFIED ADS.

Downward Trend Is Checked in East

Bottom Believed Reached in Current Movement, but Continued Dumping of East Texas Oil Threatens to Undermine Position

By A. E. Mockler
New York Bureau, The Oil and Gas Journal, Rooms 1919-21, No. 154 Nassau Street

NEW YORK, June 1.—The downward trend in refined products prices has been checked in eastern markets, temporarily at least, and developments during the last week have tended to bear out the previously expressed belief of many local factors that the market had about reached bottom for the current move.

Of outstanding interest in the week's developments was the announcement that Sinclair Refining, one of the leading marketers in this territory, was introducing a "third quality" gasoline to be sold in competition with the product marketed by independent cut-price distributors. This step was taken as an indication that the larger interests are prepared to "fight fire with fire" and that, where necessary, quality would be subordinated to price when it comes to the question of holding business.

Eastern oil men are watching with concern the difficulty which is being experienced in achieving effective proration of crude production in East Texas. Continued dumping of excessive output from this area, and certain other producing territories, is tending to undermine the position of the refined products market and unless some semblance of stability is achieved by the crude oil market it is expected that small refining interests will be in a position to keep the gasoline market disturbed throughout the summer months by marketing gasoline refined from distressed crude at prices under those at which the rank and file of the industry, operating at posted price schedules for crude, will be able to produce.

The double week-end holiday, in observance of Decoration Day, saw an exceptionally heavy movement of gasoline in both tank car and tank wagon markets, stimulated in no small degree by the unusually balmy weather which prevailed throughout the entire week, and which was instrumental in forcing jobbers into the wholesale market to replenish depleted stocks.

Refinery Gasoline

While the market undertone remains easy, posted prices continued unchanged throughout the week, with most of the leading sellers quoting 5¾ cents per gallon, a few asking 6 cents, and one seller of California motor fuel quoting 6¾ cents, all prices for U. S. Motor in tank car lots, f.o.b. refineries or bulk marine terminals.

Steadily increasing consumption had tended to create a better feeling in the market, and there was little price cutting reported below the 5¾-cent level on tank car business, although competition for business on barge lots continued keen and the market for motor fuel in large lots was weak and unsettled.

East Coast refinery holdings of gasoline as of May 23 amounted to 8,414,000 bbls., a decrease of 19,000 bbls. for the week. It was unofficially reported at the close of the past week that exceptionally large withdrawals from storage had been made throughout the East to take care of the increasing consumption.

Both California and Gulf Coast gasolines are available in liberal quantities at laid-down prices fractionally under the inside prices at which spot business is being done, but with the established factors in Atlantic Coast territory showing a willingness to meet price competition whenever and wherever it develops, independent operators are proceeding very cautiously in the matter of contracting for "outside" gasolines in cargo lots. Any pronounced price recovery in eastern gasoline markets, however, would undoubtedly be followed by heavy shipments of outside motor fuel into East Coast ports.

Eastern refiners are hopeful that some of the extremely low gasoline quotations reported from the Gulf and California during the past several weeks will have the effect of stimulating export demand, as prices for American motor fuel are now getting down to a point where the domestic product is once again competitive in price with Russian and Rumanian gasoline. Any substantial increase in export demand, it is pointed out, would tend to materially relieve the selling pressure on domestic markets.

Tank Wagon Gasoline

Featuring the week's tank wagon market was the announcement of the introduction of "Sinclair green" gasoline into New York territory. This product, described as a third-grade gasoline, is designed to sell in competition with the low-grade motor fuels which price-cutting independents have been marketing with such success during recent months, to the detriment of the general market for gasoline throughout the area.

The new third-grade product was placed on sale at the close of the week at Sinclair stations in New York City, Newark, New Brunswick, Atlantic City, Asbury Park, Hammondton, Bridgeton, Camden, Little Ferry, and Jersey City, N. J., and at Mount Vernon, N. Y. It will sell at 3 to 5 cents per gallon under the posted price for leading brands, according to the type of local competition it is called upon to meet. The company in recent weeks has placed "Sinclair green" gasoline on sale in 465 highly competitive towns and cities throughout the 18 states in which its marketing division operates. It is unofficially reported that locally the sale of the third-grade product will in most instances be confined to stations adjacent to pumps operated by price-cutting marketers.

Sinclair's step in this direction, it is expected, will force other marketers to put out a comparatively low-grade product to meet the growing competition from this type of motor fuel. During the past year or so, most of the major companies in this territory have so substantially increased the quality of their regular tank wagon gasoline that U. S. Motor has come to be regarded as relatively low-grade fuel. By marketing improved gasoline at no advance in prices, the major companies have opened the door for independents, selling a product in most respects as good as the former "standard" brands of leading integrated companies, to come into the territory on an extensive scale and established substantial gallonage totals through price-cutting marketing operations.

There were no general changes in posted price schedules throughout the local territory during the week.

Substantial increase in consumption was keeping tank wagon delivery departments active last week, particularly toward the week-end, when overtime operations were the order of the day. This increase in operations was coincidental with a sharp pick-up in tank car gasoline movement and kept the refinery terminals "on the jump."

Today officially ushers in the summer motoring season, and weather developments during the present month and July and August will play an important part in determining the future of the gasoline market. With refineries operating on curtailed schedules, a protracted spell of favorable weather would have a definitely stimulating effect upon the gasoline market position and would go far toward correcting many of the ills which have come upon the petroleum industry through overproduction of both crude and products.

Kerosene

Warm weather has tended to curtail kerosene consumption, and refinery markets were dull throughout the past week. The posted price for 41-43 water white in tank car lots holds at 5¾ cents per gallon at refineries, but 5¼ cents represents the actual market on spot sales.

Tank wagon movement of kerosene was likewise quiet last week, but no revisions in posted price schedules developed during the period.

Lubs

Increasing consumption of motor oils has tended to bring about a more optimistic feeling in the cylinder oil market, and prices remained fairly steady during the week under review. Compounders were coming into the market for prompt shipment stocks in fair volume, although there was still a noticeable lack of interest in offerings for later delivery. The market was fairly steady, from a price standpoint, no revisions developing during the period, and there was a growing belief among operators in the local market that cylinder oil prices had reached bottom, and that a slow recovery in prices might logically be expected. This opinion was by no means unanimous, however, and some interests are still decidedly bearish on the outlook.

Red and pale oils continued to move from refineries in routine quantities at unchanged prices.

Recent weakness in cylinder stocks resulted in a market increase in retail marketing operations by small independents, many of whom are now selling good grades of Pennsylvania base oil at 50 to 60 cents per gallon in 5-gallon tins. Leading sellers, however, continue to hold their prices to from $1 to $1.25 per gallon in 1-gallon lots.

Fuel Oil

Bunker "C" remains unchanged at 95 cents per barrel, bulk, at refinery terminals. Demand from marine interests is well sustained, and gallonage in many instances is running ahead of refiners' expectations. Shipping operations are improving slowly, and consumption of fuel oil is picking up proportionately.

The low price at which bunker oil is available in eastern markets has effectively shut off competition from Gulf and California sellers, and East Coast sellers are showing a disposition to meet whatever price competition might develop from those areas on any industrial business.

Diesel Oil

Refiners report a good movement of Diesel oil and the posted price of $1.65 per barrel at terminals continues unchanged. Consumption of Diesel oil has suffered less from the curtailment in shipping operations than has been the case with either coal or bunker "C" oil, it is reported, and current gallonage is described as satisfactory.

East Coast refiners are striving to preserve the balance of the Diesel oil market by limiting their output to sales requirements, and avoiding the accumulation of burdensome surplus stocks of this oil.

Gas Oil

Sluggish demand for gas oil is reported, and the market is in quiet position with 28 plus recycled oil unchanged at 4 cents per gallon in bulk, tank car lots, f.o.b. refinery terminals.

Consumption of gas oil by gas manufacturing companies is being adversely affected by the increasing use of bunker oil by these companies.

Refiners have booked substantial quantities of gas oil for delivery next winter as fuel for domestic heating plants, but the spot demand for gas oil for this purpose is practically over for this season.

Paraffin Wax

Export inquiry for fully refined grades has picked up a little during the past week, with some spot business passing. The quantities involved in the business already placed, however, were not sufficiently large to exert any stimulating effect on the price basis, and quotations remain unchanged at the previous week's levels.

Wax consumption by domestic manufacturers has fallen off a little, and the situation is aggravated by the almost general policy on the part of these buyers in holding down buying operations virtually to their immediate requirements. Consumers who in former years bought three to six months ahead are now operating on a week-to-week basis.

Refinery stocks of wax are large, and the market, from a statistical standpoint, is less favorable than is the case with many other refined products.

Imports

Imports of crude and refined petroleum at the principal United States ports for the week ended May 23 totaled 1,331,000 bbls., a daily average of 190,143 bbls., compared with 1,357,000 bbls., a daily average of 193,857 bbls. for the previous week and a daily average of 208,929 bbls. for the four weeks ended May 23. Details follow:

	Bbls. of 42 gals.
At Atlantic Coast ports—	
Baltimore	194,000
New York	728,000
Philadelphia	165,000
Others	244,000
Total	1,331,000
Daily average	190,143
At Gulf Coast ports—	
All ports	None
At Atlantic and Gulf Coast ports—	
Total	1,331,000
Daily average	190,143
Daily average four weeks	208,929

Distribution of total imports is as follows:

Crude	729,000
Gasoline	262,000
Fuel Oil	340,000

Export Market

The only large lot export transaction reported during the week involved 40,000 tons of California bunker oil, for delivery over the next eight months. The oil was sold to a European buyer on a c.i.f. basis, but the netback price figures out substantially in line with posted prices.

Mexican and Venezuelan producers have been compelled to lower their prices to meet competition from distressed Gulf Coast crude. Mexican heavy oil, with large asphalt content, is offering at 45 cents per barrel, plus export taxes, at Mexican terminals, this being 10 cents per barrel under recent quotations. Venezuelan crude is offering at 65 cents per barrel, which is 5 to 10 cents under recent quotations.

Export operators are still working on French inquiries for considerable quantities of crude. The buyers are in no hurry to close, as they will not require the crude for some months to come. Negotiations are complicated materially in many instances by the demands of buyers that the seller guarantee, within a close

(Continued on Page 280)

Chicago Finds Opposing Developments

Excellent Statistical Position of Gasolines and Unprecedented Demand Neutralized by Flood of Oil From East Texas

By Robert C. Conine

Chicago Bureau, The Oil and Gas Journal, 6 North Michigan Ave.

CHICAGO, June 1.—The undiminished enthusiasm of East Texas operators for producing crude oil, on the one hand, and the highly favorable statistical position of gasolines and the unprecedented demand for these products, on the other, are the opposing factors which are in the existing so-called markets making the most contradictory developments entirely plausible. There are numerous other smaller or more subtle influences which may explain the unique situation in the Chicago district in which marketers offer prices of 2¼ cents a gallon on a 100-car order from the company which supplies the taxicabs with fuel, and then offer prices ranging from 3 cents to 3½ cents on their bids for the 300,000-gallon business of the Chicago post office which may extend over a period of three months.

The influence of the East Texas developments cannot be underrated here. When the operators in this area produce double their allowable, throwing more than 350,000 bbls. of oil daily on a demoralized market at prices as low as 20 cents a barrel, the detrimental effects are probably felt most strongly in the territory which forms a strip extending northeastward on the line between St. Louis and Chicago.

Large quantities of refined petroleum products move northward on this line. The East Texas, as well as the North Texas, Panhandle and Oklahoma refinery output cannot be important competitive factors on the Gulf Coast, obviously, nor can they cope on an equal footing with Louisiana on an eastern movement as this State has a rail rate advantage of as much as seven-tenths of a cent a gallon.

The procedure of one East Texas refiner is enlightening. This operator has adopted the policy of shipping 50 cars of gasoline at a time into Chicago consigned to himself. When the cars arrive in the city he proceeds to get rid of the gasoline himself, and it must be said that he has been very successful thus far.

Distress Gasoline Factor

The existence of large quantities of "distress gasoline" in the district for some time has not been ignored, but the expectation of improvement in the East Texas situation gives this condition the appearance of a temporary thing that would soon be out of the way leaving the road clear for building the price structure back up at least to the point where a two or three-car order would not be disruptive. The price cut on the crude oil to 30 cents a barrel, followed by the information that the 602 wells in the field are producing double their allotment under the proration scheme, and that the total number of wells is expected to reach 1,000 by the middle of July, has effectively changed the outlook.

At this time it seems evident that the 2¾ cents price on U. S. Motor gasoline, generally accepted as the bottom of the market at last, was resting on a false bottom. A persistent rumor is making the rounds to the effect that a Texas refiner is offering his gasoline at 1¾ cents a gallon, basis Group 3, although the refiner in question asserts that his price is 2¾ cents.

Benzoline Motor Fuel Co., which supplies the fuel for the city's taxicabs, bought 100 cars of U. S. Motor gasoline last week from one of the major refiners at a price of 2¼ cents a gallon. Another major refiner sold 40 cars of U. S. Motor, not for resale, for 2.55 cents a gallon at Minneapolis. Two others of the larger refiners have quoted similar prices on orders above 10 cars, while there are almost any number of smaller interests offering these low prices on one and two-car orders. Not a few of the sales managers of the larger companies admit that they are getting a better price for their kerosene than for their gasoline.

Hesitancy Noted

An interesting development is seen which some contend indicates that while the markets for the moment are almost completely disordered and frantically competitive, there is a strong undertone of expectancy for improvement within the next few weeks. The following facts are the nucleus of this development.

Requests for bids from marketers on two-car orders of U. S. Motor gasoline brought responses from as many as 38 bidders near the close of last week with the prices ranging from 2½ cents to 3 cents. The number of bidders is significant and the same situation was repeated in three separate calls for bids. The unusual number of marketers competing for these small orders is explained, from one point of view, by the fact that buyers are now broadcasting their requests for bids to the entire mailing list. It remains now for these buyers to advertise for bids on a car of gasoline.

A situation which conflicts with conclusions which may be drawn from the activity of marketers in connection with the sale of two cars of gasoline for immediate delivery is that following the request of the Chicago post office for bids on 300,000 gallons. Only seven companies placed bids, as follows:

	Flat rate cents per gal.		
Company—	1 mo.	2 mo.	3 mo.
Commerce Petroleum	.03	.03	.03
Jewett & Sowers	.03	.03¼	.03¼
Deep Rock Oil Corp.	.03¼	.03¼	.03¼
Seneca Petroleum Co.	.03½	.03½	.03½
George C. Peterson	....	....	....
Service Oil	....	....	....
Apex Co.	....	....	....

No flat bids were submitted by George C. Peterson Co., Apex Motor Fuel Co., and Service Oil Co. These companies, as did the others, submitted bids to supply the gasoline on a differential price based on the average tank car price of a certain daily newspaper on date of shipment. The Apex company is now supplying gasoline for this quarter on a contract based on the flat price of 3¾ cents a gallon.

Rain Spoils Hopes

The city of Chicago Saturday was prepared to make deep inroads into the abundant supply of gasoline available. Decoration Day is an event which calls for parades, long trips into the country, in brief, the holiday is one of the most closely observed in the calendar and the buyers were calling out large orders from the refineries in preparation for the occasion. Then Jupiter Pluvius reappeared after a respite of four sunny days and proceeded to let fly an assortment of rain which ranged from torrential proportions to an uncomfortable drizzle throughout the day.

Briefly told the gasoline market situation in the Chicago district is this, as told by major as well as minor marketers: Sellers are willing to shade off almost any price to get business which will take material off their hands immediately, but they are afraid to close deals which extend over any period for the reason that they are convinced that the policies directing the price cutting activities on the aggressive side are as unsound as they are desperate and will encompass the destruction of all who are bringing the industry down to a level of purely low price competition.

One thing seems to be generally understood and that is that practically everything that could affect the course of the oil industry is in motion, for good or bad, and that the crisis is in the immediate future holding the fate of a number of veteran refiners as well as that of those operators who have played the role of opportunists.

The third grade of gasoline appears to be a well established institution, at least in this territory, and thus the regular grades of gasoline have been permitted to assume an aspect of solidity in the tank wagon and service station markets. In the regular grades the price competition, in spite of appearances, continues to rage, but is restricted to offers made in the matter of discounts. These discounts range in the tank wagon markets from the Standard Oil Co. of Indiana's 3½ cents below the tank wagon posting on Red Crown on quantities of 1,000 gallons or more, to a discount of 5½ cents on this posting by other marketers, some of them in the major class.

Tank Car Markets

At the close of the week the tank car markets on gasoline were unsteady at the following prices: 58-60 gravity, 437 endpoint, 2½ cents to 3⅛ cents; 60-62, 400 endpoint, 3 cents to 3¼ cents; 64-66, 375 endpoint, 3¼ cents to 3⅝ cents; 64-66, 437 endpoint blended gasoline, 2½ cents to 2¾ cents; and 68-70, 360 endpoint, 3½ cents to 3¾ cents. The lows of the ranges slipped down as follows: For 58-60, 437 endpoint, one-fourth cent; for 60-62, 400 endpoint, one-eighth cent; for 64-66, 375 endpoint, one-fourth cent; for 64-66, 437 endpoint blend, one-eighth cent, and for 68-70, 360 endpoint, three-eighths cent.

The Stanolind Blue markets, service station, were reduced at Des Moines, Milwaukee and South Bend as follows: Des Moines, 2.6 cents to 9.9 cents, including 3-cent tax; Milwaukee, 1.1 cents to 12 cents, including tax of 4 cents, and South Bend, 0.9 cents to 12.5 cents, including tax of 4 cents.

A recent step on the part of the trackage station interests promises interesting developments. This is the introduction of a premium fuel at these stops. This is not primarily an antiknock gasoline as it rates around 60 octane number, or slightly above, but it is intended to meet the major interests on the basis of the major interests' regular grades. A distillation test of this answer of the cut price operator to Stanolind, and other Blues and Greens, follows:

Octane number	60
Gravity	62
Initial	92
5 per cent	122
10 per cent	137
20 per cent	165
30 per cent	188
40 per cent	210
50 per cent	228
60 per cent	248
70 per cent	272
80 per cent	302
90 per cent	342
Endpoint	400
Recovery, per cent	97.5
Residue, per cent	01
Loss, per cent	01.5

This gasoline sells at the service stations for 12 1/7 cents, 3-cent tax paid, in quantities of 7 gallons. For less than 7 gallons the price is 13 cents a gallon. On a 5-gallon purchase the price of this gasoline is 1 cent above the price of Shell's 60 octane number, 400 endpoint gasoline which sells regularly at 1 cent above the Stanolind Blue market. The tank car price of this gasoline offered to cut price stations is 3⅛ cents to 3¼ cents.

Larger Demand for Blended Gasoline

Among the trackage stations there is an increasing demand for blended gasoline to meet the third-grade competition and enable the smaller interests to offer an inducement of a price 1 cent below Stanolind Blue. This activity is reflected in the large quantities of natural gasoline which are finding their way into this territory. However, the price of natural gasoline in the district has anything but weakened because of the influx and promises to be one of the bright spots in the market. This has, naturally, given strength to the position of the two grades of naphtha used in blending.

The 50-52 gravity, 437 endpoint naphthat which is more popular continues to hold at a range of 3 cents to 3⅛ cents, while the 450 endpoint naphtha of the same gravity is steady at 2⅞ to 3 cents. The natural gasoline markets are unchanged but expected to rise shortly.

Lubricating Oils

Little change is noted in the markets for bright stocks and neutrals. One of the interesting events in respect to lubricating oils during the past week is the sale being conducted by one of the larger department stores on medium and heavy motor oils. This store offers to deliver lubricating oil to any place in the city of Chicago at a price less than 10 cents a quart.

(Continued on Page 280)

CLASSIFIED WANTS

(Continued from Page 267)

POSITIONS WANTED

CONSTRUCTION, or operating superintendent of casinghead gasoline plants. Qualified to handle several projects in the oil and gas business. Can furnish good reference. Will go anywhere in U.S.A. Write Box E-488, The Oil and Gas Journal, Tulsa, Okla.

GRADUATE CONSTRUCTION ENGINEER-SUPERINTENDENT. Eight years' experience refinery and main line pump station construction. Estimator. Desires permanent position with reliable concern. Available June 1. Desired references furnished. Write Box E-494, The Oil and Gas Journal, Tulsa, Okla.

PETROLEUM CHEMIST: Five years service as an analytical, research, and petroleum chemist. Excellent references. Write Box E-500, The Oil and Gas Journal, Tulsa, Okla.

POSITIONS WANTED

PETROLEUM CHEMIST with six years experience in complete oil refining. Gas analysis and knock testing. Available June 10. Write, Box E-485, The Oil and Gas Journal, Tulsa, Okla.

A FORMER Chicago manufacturer opening sales office in San Francisco will consider proposal from eastern manufacturers desiring Pacific Coast representation. Write Box E-477, The Oil and Gas Journal, Tulsa, Okla.

OFFICE SPACE

NEW YORK OFFICE SERVICE

You may have a New York office at nominal cost. We offer individual rooms or parts of rooms in an impressive floor suite, with stenographic service, reception service, telephone and all facilities. Ideal location.

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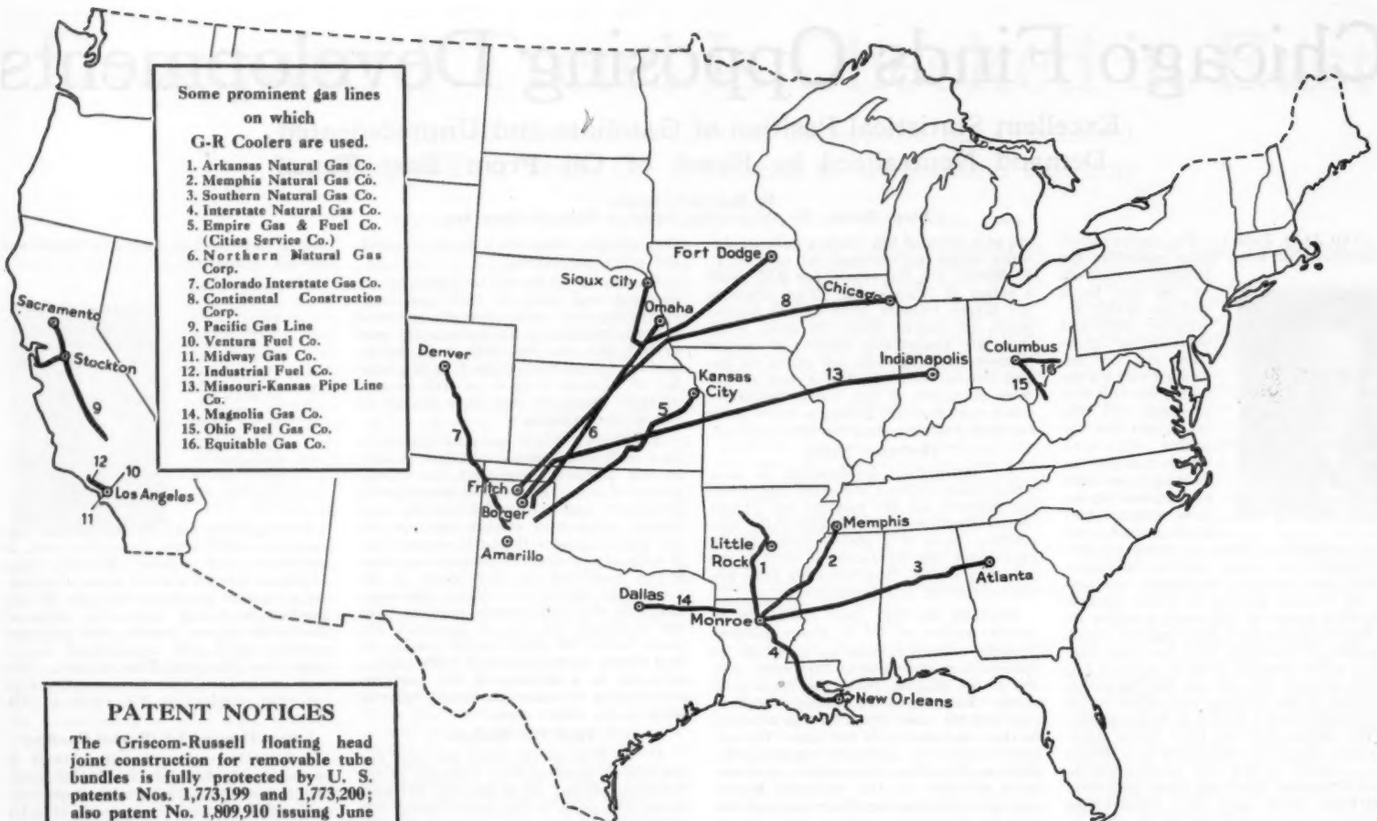
22nd Floor, 401 Broadway,
New York City, New York.



PATENT NOTICES

The Griscom-Russell floating head joint construction for removable tube bundles is fully protected by U. S. patents Nos. 1,773,199 and 1,773,200; also patent No. 1,809,910 issuing June 16, 1931, and pending patent applications, as applied to all types of tube sheets.

The G-R Bentube Section is patented and it is our intention to prosecute all infringements. Infringement suits have already been filed in two instances.

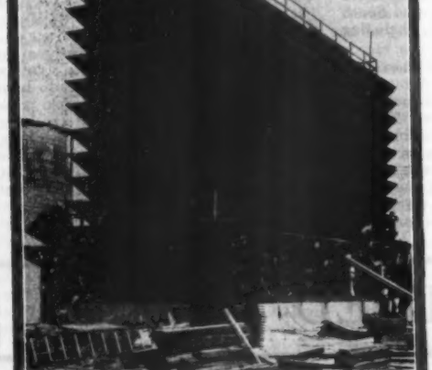
AS the gas lines spread out, the popularity of G-R Cooling Apparatus for pumping station service is steadily increasing. G-R Closed Coolers or Atmospheric Bentube Sections are being used for cooling the compressed gas on practically all of the large lines built in the last five years.

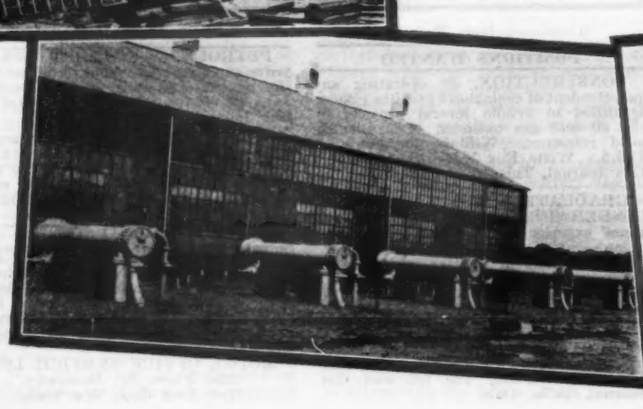
The Griscom-Russell Co., 285 Madison Ave., New York

Branches in principal oil centers.

Griscom-Russell

Heat Transfer Apparatus





Typical installations of G-R Bentube Sections and Closed Coolers on gas-cooling service.

Brief Items for Petroleum Refiners

FLORIDA TO PROPOSE 8-CENT GASOLINE TAX

Florida proposes to increase its revenue by imposing an additional tax on the consumption of petroleum products. One bill to be passed upon calls for a 2-cent excise tax to be collected on gasoline in addition to the present tax of 6 cents. Another bill has been introduced which will place a tax of 5 cents per gallon on all kerosene consumed.

A bill, tending to show that opposition will be given any proposed increase in the tax, was introduced into the senate which asks that a law be enacted prohibiting collecting a total state tax in excess of 5 cents on any petroleum product regardless of the form or forms of the tax levy.

PETROLEUM REFINING COURSES

Special courses in petroleum refining, introduced in summer session for the first time last year, will again be offered by the department of chemical engineering of the Massachusetts Institute of Technology in the summer school which is to be conducted from July 20 to August 21. Engineers and research workers from 17 different oil refineries in the United States and Canada studied at the institute last year.

A feature of this year's summer school will be a seminar on petroleum refining to be conducted by Dr. Warren K. Lewis, professor of chemical engineering. This seminar is designed for advanced students, and proposes to study the physical behavior of hydrocarbons under high pressure, a subject of great interest in view of recent advances in petroleum refining.

MID-CONTINENT FIRE

An explosion and fire took the life of one workman and injured two others at the West Tulsa refinery of the Mid-Continent Petroleum Co. Saturday afternoon of this week. Cause of the explosion has not been ascertained. Repairs on the pressure still which caused the loss are under way and no serious damage was caused in the balance of the plant as the fire was brought under control within 45 minutes. Ren Armstrong, gauger who was killed, leaves a family of four.

PROPOSE NEW REFINERY

DENVER, Colo., June 1.—The Montana Producing & Refining Co. of Denver has made inquiries for the building of a refinery near Opal, Wyo., in the LaBarge Field. It is said the company has made options on sufficient production in the field to assure construction of the plant. C. L. Smith of Denver, former state legislator, is heading the new company.

MAY BUY DAYTON REFINERY

Negotiations are said to be under way for the purchase of the State Oil & Refining Co.'s refinery at Dayton, N. Mex., by the Maljamar Oil & Gas Co. The company was shut down several weeks ago and a contract was let by the state highway department of New Mexico for $80,000 worth of road oil to the Petrol Corp. of California.

NEW YORK REFINERY

BOLIVAR, N. Y., May 30.—W. E. Sawyer and associates, of this city, have plans for the construction of a modern oil refinery on a site recently acquired along the right of way of the P. S. & N. Railroad here. The new plant will have a daily capacity of 1,500 to 2,500 bbls.

RUSSIA CONTINUES EXPANSION FIVE-YEAR REFINERY PROGRAM

NEW YORK, June 2.—Development of Russia's petroleum industry continues at a rate in excess of that laid down by the five-year plan, according to a report received this week by Amtorg Trading Corp., American commercial representatives of the U.S.S.R.

"In 1930," says the report, "the Soviet Union produced 18,650,000 tons, double the pre-war amount. This year's program calls for an output of 26,633,000 tons of oil, which will be triple the pre-war production. Under the original five-year plan the daily oil output was to reach 57,000 tons in 1932-33. However, during the first 10 days of March the average output amounted to 58,000 tons. Thus, the present production already surpasses that scheduled for the end of the five-year plan.

"The refining of oil is also progressing favorably. Under the five-year plan the daily amount of oil distilled in 1932-33 was to be 52,200 tons. Last February the daily average was 48,800 tons and the figure set for the last year of the plan will shortly be surpassed. In 1913, the oil industry employed about 52,000. In 1930, their number was 72,000 and this year the figure is expected to rise to 81,000.

"Working conditions have radically changed. The pre-war earnings of an oil worker amounted to about 430 rubles per year on the average (according to the inquiry of 1909). In 1930 the average yearly wages in the oil industry reached 1,144 rubles and in 1931 the average according to the plan should be 1,181 rubles. The increase in real wages was even greater. Before the revolution only a negligible section of the workers enjoyed vacations and only about half of the force was subject to sickness benefit, which did not amount to the full wages. There was no provision for health resorts and sanatoria for workers. At the present time the workers all enjoy an annual vacation period with full pay and receive their full wages from the insurance fund in case of illness. Workers not only receive medical treatment free of charge, but are also sent to health resorts and rest homes.

"Before the war the average hours were 10 per day. At the present the seven-hour day is being introduced, and in a number of oil plants the workers are already enjoying the seven-hour day. Large sums have been invested in housing schemes and the oil workers have been moved from their old and ramshackle huts into modern houses with all conveniences. In 1931 another 14,000,000 rubles will be spent in building houses for the oil workers. A number of large kitchen factories have been constructed. The kitchen factories of Baku have a capacity of 160,000 meals per day.

"The Oil Syndicate is now preparing a plan of further development under which the output of 1933 is tentatively fixed to be two and a half times as large as the estimate for that year under the five-year plan. In 1929-30, the sum of 300,000,000 rubles was invested, and this year 400,000,000 rubles have been assigned to the oil industry.

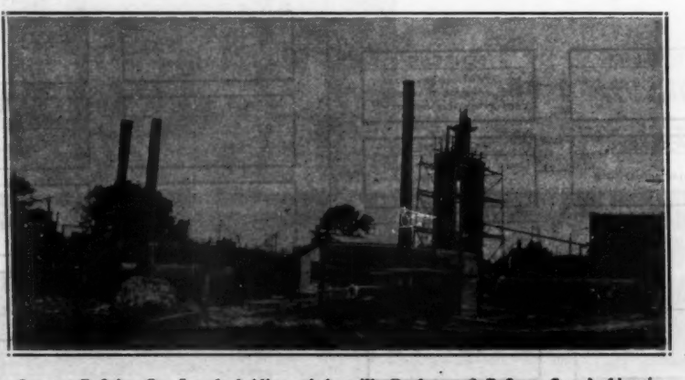
"An extensive program of oil refineries and pipe lines is being carried out. This year new factories are being built with a capacity of 8,800,000 tons per year. A factory is being built which will work over 1,300,000 tons of mazout annually. Twenty new cracking plants are being installed in different factories to obtain benzene from mazout; together they are expected to yield 1,000,000 tons of benzene per year.

"The existing factories are also being extended and modernized. The paraffin mill in Grozny, which had a capacity of 10,000 tons per year, is being enlarged to a capacity of 24,000 tons. The number of oil pipe lines is being constantly increased. In addition to the Baku-Batum pipe line of 840 kilometers, there is the Grozny-Tuapse pipe line which at present handles 1,000,000 tons annually. The latter is being increased to a capacity of 1,700,000 tons. A new pipe line is being built from Grozny to the Ukraine, over a distance of more than 1,000 kilometers. Its capacity will be 2,500,000 tons of oil products annually. Another pipe line is being built between Maikop and Armavir.

"Much attention is being given to the supply of electrical power to the oil fields and refineries. The 'Red Star' electrical station of Baku is being enlarged from 100,000 to 124,000 kw., while the 'Leon Krassin' power station is also being extended from 18,000 to 62,000 kw. capacity."

While refiners in the United States face a prolonged period of low prices and overproduction, the hope of expanding the foreign markets has been dampened by the activities of the Russian program of developing a refining industry. The success of the Russian program has been questioned since its first announcement but many are now inclined to take it more seriously.

ONE OF THE NEW EAST TEXAS REFINERIES



Overton Refining Co., Inc. (subsidiary of Amarillo Producers & Refiners Corp.) skimming plant located at Overton, Tex.

REFINERY CREDIT MEN WILL HOLD MEETINGS

A credit conclave of the representatives of the petroleum industry, numbering about 30 credit executives, will be one of the 22 credit group conferences which will feature the Credit Congress of Industry of the thirty-sixth annual convention of the National Association of Credit Men at Boston, Mass., June 22-27, it was announced recently by W. S. Swingle, convention director of the association.

The petroleum conference, under the chairmanship of C. E. Votrian, assistant treasurer of the Barnsdall Refineries, Inc., of Tulsa, will meet along with the other groups on Friday and Saturday, June 26 and 27. The Credit Congress of Industry, of which this group is a part, has grown out of the credit group sessions which have been held at each convention since they were successfully introduced in 1924.

ORDER INSPECTION

NEW YORK, May 29.—The New York Department of Agriculture and Markets has ordered a special survey throughout the State of gasoline and oil-dispensing apparatus at gasoline stations and garages.

Numerous complaints have been received recently by the department regarding the installation and use of pumps without inspection and sealing, as required by law.

All pumps in the State will be inspected for accuracy, and severe penalties inflicted on dispensers whose equipment does not bear the official seal, a department announcement states.

REFINERY PLANT WRECKED

CHATHAM, Ontario, May 30.—The entire refinery plant of the North Star Oil Co. at St. Boniface near Winnipeg, Manitoba, was wrecked by an explosion on May 27. Fire followed the blast and raged for three hours before it was brought under control. The explosion occurred in the motor room, the cause being unknown. Firemen prevented the blaze from extending to the oil tanks. No one was injured.

SUPPLY LAKE TANKERS

TOLEDO, Ohio, June 2.—The Standard Oil Co. of Ohio is building a 6-inch line from its Toledo refinery to the National Refining Co. tanks on the Maumee River. The line is being laid by the Buckeye Pipe Line Co. This will afford a more ready means of supply for the National Refining Co. tankers which distribute the refined oils to the river and lake markets.

START WYOMING PLANT

CASPER, Wyo., May 30.—Northwest Stellarene Co.'s new refinery at Coutts, Alberta, which will be operated on crude from the Kevin-Sunburst and Border Fields, is near completion and should be in operation within a short time. Plant is to specialize in the manufacture of an improved antiknock gasoline to be marketed under the trade name "Stellarene."

MAY BUILD REFINERY

The Independent Refining Co. is planning to build a skimming plant at West Mineola, Wood County, Texas, according to an announcement of the past week. The plant, which will have a capacity of 1,000 bbls. daily, is to be located along the Texas & Pacific Railroad. Wood County is located in the East Texas area.

Manufacture of Natural Gasoline

California Stocks Natural Gasoline Increase in April

Natural gasoline stocks increased 152,026 bbls. in California during April, bringing total stocks on May 1 to 1,695,831 bbls., or a supply of 41 days at the current rate of consumption. Of this total 101,250 bbls. are being held by natural gasoline manufacturers and 1,594,581 bbls. by refiners.

A slight decrease in production was effected during the month, the total output being reported by the Bureau of Mines as 1,398,027 bbls. This represents a decrease in the daily average production of 837 bbls. when compared to March. This was produced in 130 plants with a daily capacity of 2,659,049,000 cubic feet. These plants processed 40,605,285,000 cubic feet in April.

The consumption of natural gasoline, including shipments, amounted to 1,246,001 bbls., a decrease under March of 78,637 bbls.

On this basis, the April average consumption, amounting to 41,533 bbls. daily, was 5,068 bbls. below the daily average production, causing the increase in the stocks shown above.

All fields showed a decline in the production when comparing the operations of the past two months, with the exception of the Kettleman Hills area. Here the production mounted to 353,047 bbls. and represents slightly more than 25 per cent of all natural gasoline produced in

(Continued on Page 285)

MAKE "DRY ICE" FROM RESIDUE OF NATURAL GASOLINE PLANTS

Natural gasoline manufacturers have investigated the commercial possibilities of better utilizing the residue gas from their plants and find it may be cracked to yield benzine and alcohols from which may be made many derivatives. The extraction and liquefaction of propane and butane is now beyond the "investigating" stage and is fast becoming an important industry in itself. A most recent development has been the possibilities of manufacturing "dry ice" or solid carbon dioxide. The residue gas may be burned efficiently and the carbon dioxide gas resulting may be utilized in the subsequent processing to get it into the liquid and solid forms. A part of the heat generated will be consumed in operating the plant. Because of the need for carrying on the manufacture of dry ice on a comparatively large scale, the combined operations could only be found to pay where a large natural gasoline plant may be justified and in fields where the residue gas is wasted or turned into the field lines at a low return.

"The field of making 'dry ice' has become attractive because of the convenience in the use of the product rather than the result of the investigation of the profits afforded" is a common statement from those already engaged in the business, but the rapid increase in the number of plants and the output of these plants is not being ignored in the answer to this argument.

Solid carbon dioxide has a refrigerating effect of 275 B.t.u. compared to water ice of 144 B.t.u. The solid CO_2 has a melting point of —109.6° F., while water ice melts at 32° F. In 1931 it is estimated that 85,000,000 pounds of "dry ice" will be manufactured in the 25 plants now operating. One of these, the largest in the new industry, has a capacity of 120 tons of the new product daily and a 50-ton plant is operating at another point. The larger plant is located at Niagara Falls, N. Y., and the next largest is in Peoria, Ill.

At present, 90 per cent of this product is used in the transporting of ice cream. About 6 per cent is used in the preservation of meats and the balance finds use in scattered industries. When suitable containers and insulation is devised, it is expected that railroads will avail themselves of "dry ice" in recognition of its lesser weight for a given refrigerating effect.

However, the gasoline industry is not alone in the field looking for means of utilizing by-products. In fact, other industries seem to hold certain advantages in this adventure. The lime industry, for instance, produces large quantities of CO_2 gas in the roasting of carbonate rock. Practically all industries burn fuels of one form or another, and produce large quantities of CO_2 gas in the mixture of stack gases.

The degree of purity of the CO_2 gas is an important consideration in fixing the cost of its further processing into the form of a solid or a liquid and in most cases this gas is badly contaminated with SO_2, CO, unburned oil vapors and carbon. The cost of recovering the CO_2 gas will thus often prove prohibitive.

Possibly, the natural gasoline plant of the future will extract the heavier fractions to make motor fuels, liquid gases and then by pyrolysis produce alcohols, ethylene, etc., and the flue gases will be processed for the manufacture of "dry ice," in which a favorable heat balance will be effected among the three operations.

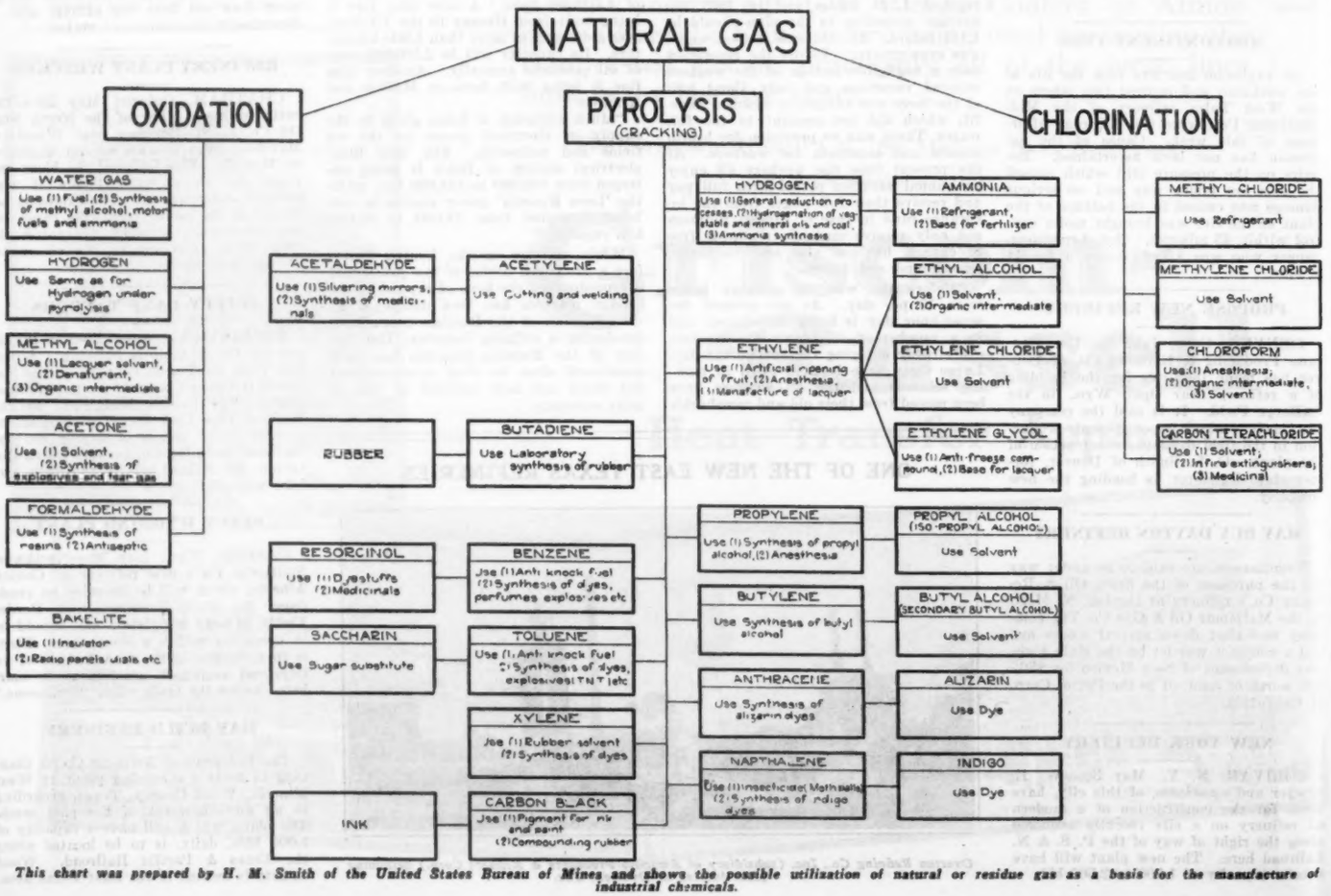
CONCENTRATE ON LARGE USERS

The Union Oil Co. of California recently announced its entry into the sale of liquid gas. This will be manufactured in the company's refinery near Los Angeles instead of the gasoline plants. The gasoline will be piped from the absorption plants to the refinery where a 30,000-gallon special stabilizer is being built.

It is the plan of the marketing department to concentrate on the larger commercial users and no house to house distribution of the fuel is anticipated.

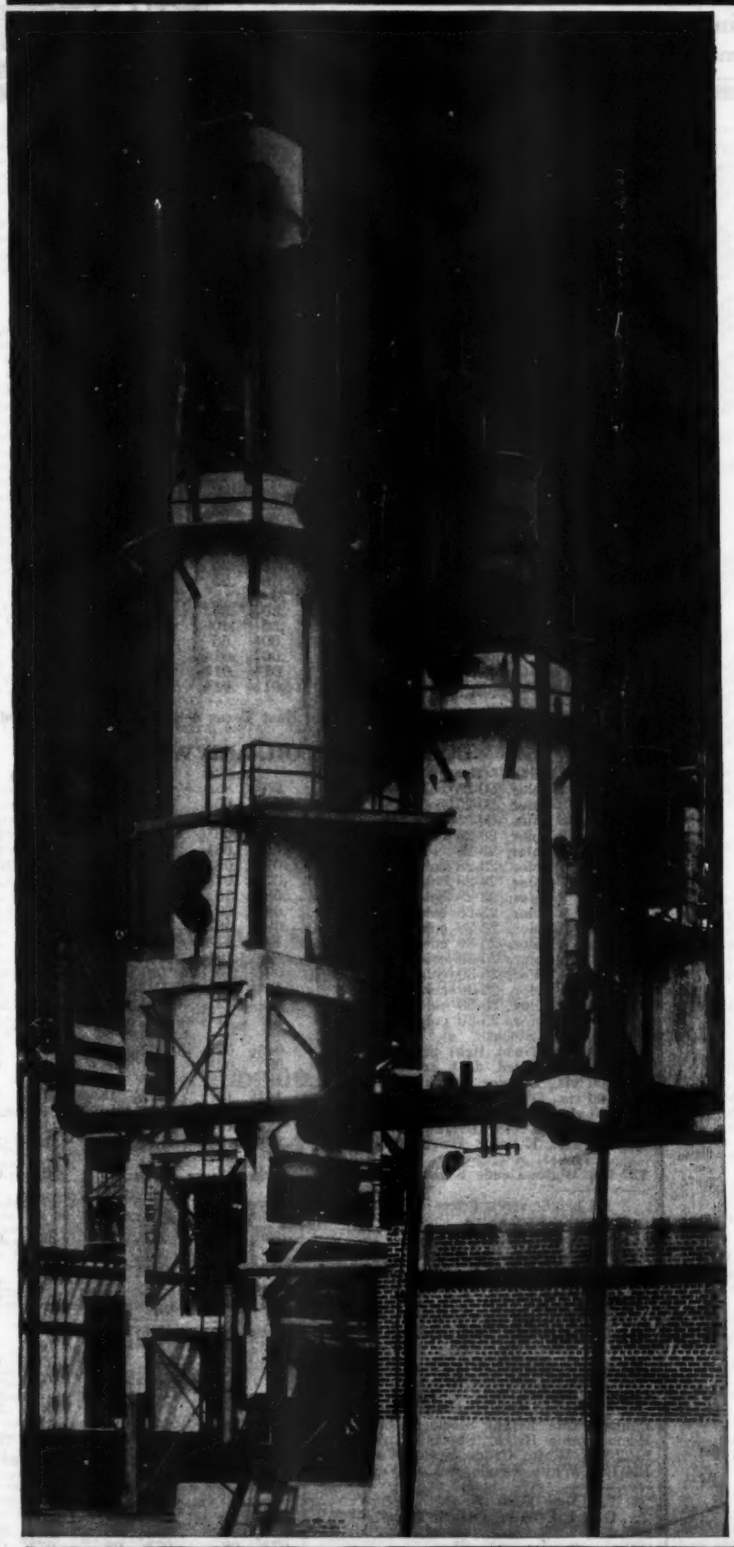
CHANGE SAXET NAME

HOUSTON, Tex., June 1.—The Saxet Co., producers and marketers of natural gasoline on the Gulf Coast and in Southwest Texas, announces that a stockholders' meeting will be held June 10 to change the name to Republic Gas Corp. The Saxet recently entered the southwest Kansas gas field.



This chart was prepared by H. M. Smith of the United States Bureau of Mines and shows the possible utilization of natural or residue gas as a basis for the manufacture of industrial chemicals.

THE ESSENTIAL ELEMENT



The physical equipment which constitutes a refining unit is merely the external expression of the builder's work. Back of the materials of construction there is one essential element, engineering, which evidences itself and is measured by the operating results. Without this essential element of engineering the imposing externals have no significance.

Lummus builds into every detail of its equipment the engineering skill acquired in 30 years of experience in the design and construction of distillation and refining equipment. There has never been a Lummus installation which has failed to deliver guaranteed capacity or products.

THE LUMMUS CO.

Builders of Petroleum Plants

• • •

148 STATE STREET, BOSTON
30 CHURCH STREET, NEW YORK

LUMMUS PETROLEUM REFINING PLANTS

REFINERY AND CRUDE PRICES

Quotations on refined products are for interstate or export movement unless otherwise noted.

GASOLINE AND NAPHTHA

OKLAHOMA (Group 3)—	June 2		May 26		May 19	
50-52 450 endpoint	.02¾	.03	.02⅞	.03	.02⅞	.03
56-58 450 endpoint	.02⅞	.02¾	.02⅞	.02¾	.02¾	.03
58-60 437 endpoint (U. S. Motor)	.02⅝	.03	.02¾	.03⅛	.02⅞	.03⅛
60-62 437 endpoint	.02⅝	.03⅛	.02⅞	.03⅛	.03	.03⅛
60-62 400 endpoint	.02⅞	.03⅛	.03	.03⅛	.03⅛	.03⅛
64-66 375 endpoint	.03⅛	.03⅛	.03⅛	.03⅜	.03⅜	.03⅜
68-70 360 endpoint	.03⅜	.03⅜	.03⅛	.03⅜	.03⅜	.03¾
64-66 437 endpoint (blend)	.02½	.02¾	.02⅝	.02¾	.02¾	.03
NORTH TEXAS—						
50-52 450 endpoint	.02¾	.03	.02¾	.03	.02¾	.03
58-60 450 endpoint	.02⅞		.02½	.02¾	.02¾	
58-60 437 endpoint (U. S. Motor)	.02⅞	.02¾	.02⅝	.03	.02¾	.03
60-62 400 endpoint	.02¾	.03⅛	.02⅞	.03⅛	.03	.03⅛
64-66 390 endpoint	.03	.03⅛	.03⅛	.03⅞	.03⅛	.03⅜
64-66 375 endpoint	.03⅛	.03⅛	.03⅛	.03⅛	.03⅜	.03⅜
68-70 360 endpoint	.03⅜	.04	.03⅜	.04	.03½	.04
64-66 437 endpoint (blend)	.02½	.02¾	.02⅝	.03	.02¾	.03
*NORTH LOUISIANA—						
58-60 437 endpoint (U. S. Motor)	.03	.03⅛	.03⅛	.03⅜	.03½	.03⅜
*ARKANSAS—						
58-60 437 endpoint (U. S. Motor)	.03	.03⅛	.03⅛	.03⅜	.03⅜	.03⅜
PENNSYLVANIA—						
52-54 Naphtha	.04⅜	.05	.04⅜	.05	.05	
54-56 Naphtha	.04⅜	.05	.04⅜	.05	.05	
58-60 Gasoline	.04½	.05	.05		.05	
60 Gasoline	.05⅛	.05⅛	.05⅛	.05⅛	.05	.05⅛
62 Gasoline	.05⅛		.05⅛		.05⅛	.05⅛
64 Gasoline	.05⅛	.05⅜	.05⅛	.05⅜	.05⅛	.06
68-70 350 endpoint gasoline	.06⅛		.06⅛		.06⅛	
CALIFORNIA—						
†54-58 437 endpoint (U. S. Motor) domestic	.03	.03½	.03	.03½	.03	.03½
†58-60 400 endpoint domestic gasoline	.03¼	.04	.03¼	.04	.03¼	.04
CHICAGO DISTRICT (Based on Group 3)—						
50-52 450 endpoint (Naphtha)	.02⅞	.03	.03		.02⅞	.03
58-60 437 endpoint (U. S. Motor)	.02½	.03	.02¾	.03⅛	.02⅝	.03
60-62 400 endpoint	.02⅞	.03	.03⅛	.03⅛	.03⅛	.03⅛
64-66 375 endpoint	.03¼	.03½	.03½	.03⅝	.03½	.03⅝
64-66 437 endpoint (blend)	.02⅝	.02¾	.02⅝	.02⅞	.02⅝	.02⅞
68-70 360 endpoint	.03½		.03⅞	.04⅛	.03⅞	.04⅛
GULF COAST (Export)—						
58-60 U. S. Motor	.04¼		.04¼		.04¼	
60-62 400 endpoint	.04½		.04½		.04½	
61-63 390 endpoint	.04¾		.04¾		.04¾	
64-66 375 endpoint	.05		.05		.05	

*Louisiana, Arkansas, Mississippi and East Texas delivery. †For local consumption.

NATURAL GASOLINE

OKLAHOMA (Group 3)—	June 2		May 26		May 19	
Grade A, 72-79.9, 375 e.p., rec. 90%	.02		.01⅞ .02		.01⅞	.01⅞
Grade AA, 80-87.9, 375 e.p., rec. 90%	.01⅝	.01¾	.01⅝ .01¾		.01⅝	.01¾
Grade B, 76-83.9, 375 e.p., rec. 85%	.01½		.01½		.01½	
Grade BB, 84-92, 375 e.p., rec. 85%	.01½		.01½		.01½	
Grade C, 80-92, 375 e.p., rec. 78%	.01½		.01½		.01½	
NORTH TEXAS—						
Grade A, 72-79.9, 375 e.p., rec. 90%	.02		.01⅞ .02		.01⅞	.01⅞
Grade AA, 80-87.9, 375 e.p., rec. 90%	.01⅝	.01¾	.01⅝		.01⅝	
Grade B, 76-83.9, 375 e.p., rec. 85%	.01½		.01½		.01½	
Grade BB, 84-92, 375 e.p., rec. 85%	.01½		.01½		.01½	
Grade C, 80-92, 375 e.p., rec. 78%	.01½		.01½		.01½	
NORTH LOUISIANA—						
Grade AA, 80-87, 375 e.p., rec. 90%	.01⅞	.02	.01⅝		.01⅝	
Grade BB, 84-92, 375 e.p., rec. 85%	.01⅝		.01⅝		.01⅝	
Grade C, 80-92, 375 e.p., rec. 78%	.01⅝		.01⅝		.01⅝	
CALIFORNIA—						
75-78 375-390 endpoint	.02	.02¼	.01¾ .02¼		.01¾	.02¼
CHICAGO DISTRICT (Based on Group 3)—						
Grade A, 72-79.9, 375 e.p., rec. 90%	.02		.01⅞ .02		.01⅞	.01⅞
Grade AA, 80-87.9, 375 e.p., rec. 90%	.01⅝		.01⅝		.01⅝	
Grade BB, 84-92, 375 e.p., rec. 85%	.01½		.01½		.01½	

BURNING OIL

OKLAHOMA (Group 3)—	June 2		May 26		May 19	
41-43 water white kerosene	.02¼	.02½	.02⅜	.02½	.02⅜	.02½
42-44 water white kerosene	.02⅜	.02¾	.02½	.02¾	.02½	.02¾
NORTH TEXAS—						
41-43 water white kerosene	.02¼	.02½	.02⅜	.02½	.02⅜	.02½
40-41 water white kerosene	.02⅛	.02⅜	.02¼	.02⅜	.02¼	.02⅜
*NORTH LOUISIANA—						
41-43 water white kerosene	.02¾	.03	.02⅞	.03	.02⅞	.03
*ARKANSAS—						
41-43 water white kerosene	.02¾	.03	.02¾	.03	.02⅞	.03
PENNSYLVANIA—						
43 Kerosene prime white	.03⅞		.04		.04	.04¼
45 Kerosene water white	.04		.04¼		.04¼	
46 Kerosene water white	.04½		.04½		.04½	.04¾
CALIFORNIA—						
38-40 water white Kero. (high burning test)	.04	.04½	.04	.04½	.04	.04½
CHICAGO DISTRICT (Based on Group 3)—						
41-43 water white kerosene	.02¾	.02½	.02¾	.02⅝	.02¾	.02½
42-44 water white kerosene	.02½	.02¾	.02½	.02¾	.02½	.02¾
GULF COAST (Export)—						
41-43 prime white	.04		.04		.04	
44 water white	.05		.05		.05	

*Louisiana, Arkansas, Mississippi and East Texas delivery.

FUEL OIL

OKLAHOMA (Group 3)—	June 2		May 26		May 19	
Below 18 gravity Fuel Oil, per bbl.	.25	.30	.27½	.35	.30	.40
18-22 Fuel Oil, per bbl.	.30	.35	.32½	.40	.35	.40
20-22 Fuel Oil, per bbl.	.30	.35	.35	.40	.37½	.42½
22-26 Fuel Oil, per bbl.	.35	.40	.40	.45	.42½	.47½
24-26 Fuel Oil, per bbl.	.40	.50	.42½	.50	.45	.50
26-30 Fuel Oil, per bbl.	.45	.55	.45	.55	.50	.55
28-30 Fuel Oil, per bbl.	.50	.60	.50	.60	.55	.60
32-36 Gas Oil (industrial)	.00⅝	.01	.00⅞	.01⅛	.00⅞	.01⅛
32-36 Gas Oil (straw color, high cold test)	.00⅝	.01	.00⅞	.01⅛	.00⅞	.01⅛
32-36 Gas Oil (straw color, low cold test)	.01⅛	.01½	.01⅛	.01½	.01⅛	.01½
36-38 Distillate	.01⅛	.01½	.01⅛	.01⅜	.01⅛	.01⅜
38-40 Straw Distillate	.01½	.01⅝	.01½	.01⅝	.01⅝	.02

Note—Fuel oils over 40 cold test generally 5 to 10 cents per barrel less.

NORTH TEXAS—						
Below 20 gravity Fuel Oil, per bbl.	.25	.35	.25	.35	.25	.35
24-26 Fuel Oil, per bbl.	.30	.40	.35	.40	.35	.40
32-36 Gas Oil (industrial)	.00¾	.01	.00¾	.01	.00¾	.01⅛
38-40 Straw Distillate	.01⅛	.01½	.01⅜	.01⅝	.01½	.01⅝
*NORTH LOUISIANA—						
18-20 Fuel Oil, per bbl.	.55	.60	.55	.60	.55	.60
30-32 Gas Oil (low cold test)	.02⅛	.02¼	.02⅛	.02¼	.02⅛	.02¼
*ARKANSAS—						
33-36 Distillate	.02¼	.02½	.02¼	.02½	.02¼	.02½
30-32 Gas Oil	.02	.02⅛	.02	.02⅛	.02	.02⅛
16-22 Refinery Fuel Oil, per bbl.	.50	.55	.50	.55	.50	.55
GULF COAST (South Texas)—						
Gas Oil	.02½	.02¾	.02½	.02¾	.02¾	.03
Bunker C Fuel (cargo lots), per bbl.	.60	.62½	.60	.62½	.60	.62½
Bunker C Fuel (small lots)	.80		.80		.80	
PENNSYLVANIA—						
30-34 Fuel Oil	.02½		.02½		.02½	
36-40 Fuel Oil	.02⅝	.02¾	.02⅝	.02¾	.02⅝	
CALIFORNIA—						
42-45 480 endpoint engine distillate	.03	.04	.03	.04	.03	.04
15-19 Fuel Oil, Bunker (at tidewater), bbl.	.80	.90	.80	.90	.80	.90
15-19 Fuel Oil (cargo lots, at tidewater), bbl.	.55	.85	.55	.85	.55	.85
†15-19 Fuel Oil, f.o.b. tank cars	.30	.70	.30	.70	.30	.70
27 plus Diesel, per bbl.	.70	.95	.70	.95	.70	.95
30-34 Gas Oil	.70	.95	.70	.95	.70	.95
CHICAGO DISTRICT (Based on Group 3)—						
18-22 Fuel Oil, per bbl.	.30	.35	.30	.35	.32½	.37½
22-26 Fuel Oil, per bbl.	.35	.40	.35	.40	.35	.40
28-30 Fuel Oil, per bbl. (zero)	.60	.65	.60	.65	.62½	.67½
32-36 Gas Oil (industrial)	.00⅞	.01⅛	.00⅞	.01⅛	.00⅞	.01⅛
32-36 Gas Oil (zero)	.01⅜	.01⅝	.01⅜	.01⅝	.01⅜	.01⅝
38-40 Straw distillate	.01½	.01⅝	.01½	.01⅝	.01½	.01⅝

*Louisiana, Arkansas, Mississippi and East Texas delivery. †Lowest priced fuel oil has high sulphur content.

LUBRICATING OIL AND WAX

OKLAHOMA (Group 3)—	June 2		May 26		May 19	
100 vis., 2 color, 20-25 cold test	.05		.05		.05	
100 vis., 3 color, 20-25 cold test	.04¾	.05	.04¾	.05	.04¾	.05
150 vis., 3 color, 20-25 cold test	.07	.07½	.07	.07½	.07	.07½
150 vis., 4 color, 20-25 cold test	.06	.06½	.06	.06½	.06	.06½
180 vis., 3 color, 23-28 cold test	.08	.08½	.08	.08½	.08	.08½
180 vis., 4 color, 23-28 cold test	.07½	.08½	.07½	.08½	.07½	.08½
180 vis., 5 color, 23-28 cold test	.07½	.07½	.07½	.07½	.07½	.07½
200 vis., 3 color, 23-28 cold test	.08½	.10	.09½	.10	.09½	.10
200 vis., 4 color, 23-28 cold test	.08½	.09½	.09	.09½	.09	.09½
200 vis., 5 color, 23-28 cold test	.08	.08½	.08	.08½	.08	.08½
240 vis., 3 color, 25-30 cold test	.11	.11½	.11	.11½	.11	.11½
240 vis., 4 color, 25-30 cold test	.10	.10½	.10	.10½	.10	.10½
240 vis., 5 color, 25-30 cold test	.09½	.10	.09½	.10	.09½	.10
280 vis., 3 color, 25-30 cold test	.12½	.13	.12½	.13	.12½	.13
280 vis., 4 color, 25-30 cold test	.11½	.12	.11½	.12	.11½	.12
280 vis., 5 color, 25-30 cold test	.11	.11½	.11	.11½	.11	.11½
Cylinder Stocks:						
600, steam refined, light green	.04½	.05½	.04½	.05½	.04½	.05½
600, steam refined, dark green	.03	.03½	.03	.03½	.03	.03½
190-200 vis., D color, Bright Stocks	.18		.18		.18	
150-160 vis., D color, Bright Stocks 0-10 c.t.	.14½	.15	.14½	.15	.14½	.15
150-160 vis., D color, Bright Stocks 10-25 c.t.	.13¾	.14½	.13¾	.14½	.14	.14½
150-160 vis., D color, Bright Stocks 25-40 c.t.	.13	.14	.13½	.14	.14	
150-160 vis., E color, Bright Stocks	.13¼	.13½	.13¼	.13½	.13½	.14
Waxes:						
124-126 White Crude Scale Wax	.01¾	.02	.01¾	.02	.01¾	.02

All bright stock prices are for domestic movement.

PENNSYLVANIA—						
34 Neutral	.05½		.05½		.05½	.06
34 Sundebloom	.05¼		.05¼		.05¼	
36 Miners' Neutral	.05½		.05½		.05½	
150, 3 color	.15½	.16	.16		.16¼	.16½
180, 3 color	.18		.18	.18½	.19	.19½
200, 3 color	.21		.21	.21½	.21½	
220, 3 color	.23½	.26	.23½	.26½	.24	
600, steam refined	.07¾	.08	.08		.08	
650, steam refined	.10¾	.11½	.11	.11¾	.11½	.12½
600, Pennsylvania Flash	.11½	.12	.11½	.12½	.12	.13½
600, E filtered	.11	.11½	.11	.12	.12	.12½
600, D filtered, Oil City	.15	.16	.15	.17	.15	.16
Pennsylvania Bright Stocks below 35 c.t.	.17		.17½	.18	.17½	
Pennsylvania Bright Stocks above 35 c.t.	.16½		.17		.17	.17½
*122-124 White Crude Scale Wax	.02		.02		.02	.02⅛
124-126 White Crude Scale Wax	.02		.02		.02⅛	

*At New York.

GULF COAST (South Texas)—						
100 vis., 2-2½ color, pale oil	.05½	.06	.05½	.06	.05½	.06
200 vis., 3 color, pale oil	.07¾	.08	.07¾	.08	.07¾	.08
300 vis., 3 color, pale oil	.09	.09¼	.09	.09¼	.09	.09¼
500 vis., 3½ color, pale oil	.10¼	.10½	.10½	.10½	.10¼	.10½
750 vis., 3½ color, pale oil	.11¾	.12	.11¾	.12	.11¾	.12
1,200 vis., 3½ color, pale oil	.14¼	.14½	.14½	.14½	.14½	.14½
2,000 vis., 4 color, pale oil	.15¼	.15½	.15¼	.15½	.15¼	.15½
200 vis., 5-6 color, red oil	.07	.07½	.07	.07½	.07	.07½
300 vis., 5-6 color, red oil	.08¼	.08½	.08½	.08½	.08¼	.08½
500 vis., 5-6 color, red oil	.09½	.09¾	.09½	.09¾	.09½	.09¾
750 vis., 5-6 color, red oil	.10½	.11¼	.10½	.11¼	.10½	.11¼
1,200 vis., 5-6 color, red oil	.13¼	.13½	.13¼	.13½	.13¼	.13½
2,000 vis., 6 plus color	.15¼	.15½	.15¾	.15½	.15¼	.15½
CALIFORNIA—						
150 vis., 2½-3 color	.09	.09½	.09	.09½	.09	.09½
200 vis., 2½-3 color	.10	.10¾	.10	.10¾	.10	1.0¾
300 vis., 3-3½ color	.10¾	.11½	.10¾	.11½	.10¾	.11½

REFINERY AND CRUDE PRICES

Quotations on refined products are for interstate or export movement unless otherwise noted.

350 vis., 3½-4 color	.11½	.11¾	.11½	.11¾	.11½	.11¾
400 vis., 3½-4 color	.12¼	.12¾	.12¼	.12¾	.12¼	.12¾
Red Neutral:						
200 vis., 4½-5 color	.09½	.10	.09½	.10	.09½	.10
300 vis., 5-6 color	.10¼	.10¾	.10¼	.10¾	.10¼	.10¾
400 vis., 5-6 color	.11	.12	.11	.12	.11	.12
500 vis., 4½-5 color	.12¼	.13	.12¼	.13	.12¼	.13
500 vis., 5-6½ color	.12	.12¾	.12	.12¾	.12	.12¾
600 vis., 6½ plus color	.13	.14	.13	.14	.13	.14

Note—Bright stocks are not manufactured commercially on the Pacific Coast.

NEW YORK (BAYONNE) REFINERY PRICES

	June 2		May 26		May 19	
Gasoline, U. S. Motor, 58-60, 437 e.p.	.05¾	.06½	.05¾	.06½	.05¾	.06½
Kerosene, water white, 41-43	.05¼	.05½	.05¼	.05½	.05¼	.05¾
*Fuel Oil, Bunker "C," 41-43	.95		.95		.95	
†Fuel Oil, Diesel, 28-30, per bbl.	1.65		1.65		1.65	
Gas Oil, 28 gravity plus	.04		.04		.04	
25 pale Paraffin Oil, tank car	.10¼		.10¼		.10¼	
28 pale Paraffin Oil, tank car	.07¼		.07¼		.07¼	
280 red Paraffin Oil, tank car	.12½		.12½		.12½	
250 red Paraffin Oil, tank car	.11½		.11½		.11½	
225 red Paraffin Oil, tank car	.10		.10		.10	
200 red Paraffin Oil, tank car	.09¼		.09¼		.09¼	
Domestic heating oil, min. 32 grav., tank car	.04		.04		.04	
Refined Wax:						
120-122 a.m.p., per lb.	.02⅞		.02⅞		.03	
125-127 a.m.p., per lb.	.03⅛		.03⅛		.03⅛	
130-132 a.m.p., per lb.	.03⅝		.03⅝		.03⅝	
133-135 a.m.p., per lb.	.04⅛		.04⅛		.04¼	
135-137 a.m.p., per lb.	.04⅝		.04⅝		.04⅝	
Petrolatum in barrels in carload lots, per pound:						
Dark Green	.01¾		.01¾		.01¾	
Amber	.03		.03		.03	
Extra Amber	.03¼		.03¼		.03¼	
Cream	.06		.06		.06	
Lily White	.06¾		.06¾		.06¾	
Snow White	.08		.08		.08	

*Lighterage 5 cents a barrel extra. †Lighterage 6.5 cents a barrel.

NEW YORK (BAYONNE) EXPORT PRICES

	June 2		May 26		May 19	
600, steam refined cylinder stocks, in bbls.	.16	.16¼	.16	.16¼	.16	.16¼
635, steam refined	.16½	.17	.16½	.17	.16½	.17
650, steam refined	.19	.20	.19	.20	.19	.20
600, Pennsylvania Flash	.19½	.20	.19½	.20	.20	.21
630, Pennsylvania Flash	.25¾	.26	.25¾	.26	.25¾	.26
060, Warren E	.19½		.19½		.19½	
600, Oil City E	.18½		.18½		.18½	
Light 140-150 Bright Stocks	.25	.26	.25	.26	.25	.26
Dark 140-150 Bright Stocks	.24	.25	.24	.25	.24	.25

LOS ANGELES EXPORT PRICES

	June 2		May 26		May 19	
Kerosene, water white	.04	.04½	.04	.04½	.04	.04½
*U. S. Motor Gasoline, 53-55, 437 e.p.	.03¼	.04	.03¼	.04	.03¼	.04
*58-62, 400 endpoint gasoline	.03½	.04½	.03½	.04½	.03½	.04½

*For coastwise shipment.

CRUDE OIL PRICES

OKLAHOMA, KANSAS, NORTH AND EAST CENTRAL TEXAS

Rusk County, Tex.* (Apr. 6, 1931).....$ .25
East Texas (May 9, 1931)‡.....40
Corsicana heavy (Apr. 23, 1931)†.....35
Other fields.....See gravity table

*Posted by Panola Pipe Line Co. For Humble Oil & Refining Co. and Magnolia Petroleum Co. posted prices on East Texas, see gravity table. †Magnolia Petroleum Co. ‡Tidal Refining Co.

TEXAS PANHANDLE

Gray County, Wheeler County and Carson-Hutchinson Counties..See gravity table

WEST TEXAS

Iatan*.....Same as North Texas
Crane - Upton - Crockett, Howard and Glasscock and Reiter (Apr. 21, 1931)†.$ .30
Winkler and Pecos, Tex. (Apr. 21, 1931)†.35
Lea County, N. Mex. (Apr. 21, 1931)..335

*Includes Westbrook Field. †Posted by Humble Oil & Refining Co.

ARKANSAS-NORTH LOUISIANA

Smackover (all grades) (Mar. 10, 1931).$ .45
Carterville, Sarepta and Cotton Valley, below 36 gravity.....See gravity table
March 10, 1931.....45
Urania (Oct. 30, 1930).....75
Calion, heavy (Mar. 10, 1931).....45
East El Dorado (Mar. 10, 1931).....45
Other fields.....See gravity table

Note—Smackover and Bellevue posted by Standard Oil Co. of Louisiana and Magnolia Petroleum Co.; Urania posted by Louisiana Oil Refining Corp.; East El Dorado posted by Gulf Refining Co. and Magnolia Petroleum Co.; Calion posted by Gulf Refining Co.

GULF COAST

Grade A (Apr. 31)*.....$ .70
Grade B, 35° and upward—See gravity table
Jennings, La. (Apr. 21, 1931)†.....75
Lockport, La., May 27, 1931‡:
Grade A.....60
Grade B.....55
Refugio, light.....Same as Grade B
Refugio, heavy (Jan. 14)*.....60
Markham (Mar. 10, 1931)‡.....50
High Island (Apr. 21, 1931)†.....65
Hankamer (Apr. 21, 1931)†.....65

*Humble Oil & Refining Co. †Gulf Refining Co. of Louisiana. ‡Texas Pipe Line Co. §Vacuum Oil Co.

ROCKY MOUNTAIN STATES
Ohio Oil Co.-Midwest Refining Co.

Ilas (Mar. 7, 1931):
38 gravity and above.....$ .72
Under 38 gravity.....50
Fort Collins (Mar. 5, 1931).....53
Florence (Mar. 5, 1931).....47
Wellington (Mar. 5, 1931).....48
Dutton Creek (Oct. 28, 1930).....1.01
Rock Creek, Wyo. (Mar. 5, 1931).....66
Salt Creek.....See gravity table
Big Muddy (Mar. 5, 1931).....95
Grass Creek, heavy (July 27, 1928).....90
Grass Creek, light (Mar. 5, 1931).....90
Elk Basin (Mar. 5, 1931).....90
Lance Creek (Mar. 5, 1931).....98
Poison Spider (Mar. 5, 1931).....70
Notches (Mar. 14, 1927).....65
Hudson (Mar. 5, 1931).....35
Lander (Mar. 5, 1931).....40
Rex Lake (Feb. 22, 1930).....1.10
Osage (Apr. 15, 1931).....98
Lost Soldier (Mar. 5, 1931).....55
Hamilton Dome (Mar. 14, 1927).....95
Greybull (Oct. 28, 1930).....1.25
Torchlight (Oct. 28, 1930).....1.25
Cat Creek (Mar. 5, 1931).....90
Pondera, Mont. (Mar. 12, 1931).....1.00
Sunburst, Mont. (Mar. 12, 1931).....1.10
Hogback, N. Mex. (Mar. 5, 1931).....1.05
Artesia, N. Mex. (Mar. 10, 1931).....40
Lea County, N. Mex. (Apr. 21, 1931)...325
Border, Mont.....1.55
Red Coulee, Alberta.....1.55

Note—Salt Creek, Cat Creek, Dallas-Derby, Hudson, Greybull and Hogback posted by Midwest Refining Co. and the remainder by the Ohio Oil Co. Both companies posted Grass Creek light and Elk Basin. Lost Soldier posted by Producers & Refiners Corp. Artesia posted by Continental Oil Co. Border and Red Coulee posted by Imperial Refining Co. Ohio Oil Co. ceased posting Artesia on March 5, 1931. Los County posted by Humble Oil & Refining Co. Fort Collins, Wellington, Orchard, Florence, Rattlesnake and Table Mesa by the Continental Oil Co. Osage posted by Arro Oil & Refining Co.

SOUTH CENTRAL AND SOUTHWEST TEXAS

Darst Creek (Apr. 21, 1931)*.....$ .52
Luling (Apr. 23, 1931)†.....38
Mirando (Apr. 21, 1931)*.....60
Pettus (Apr. 21, 1931)*.....75
Salt Flat (Apr. 21, 1931)*.....52
Thrall‡.....
Lytton Springs (Lockhart).See gravity table
Dobrowolski (Oct. 25, 1930)§.....
Same as Mid-Continent gravity scale up to and including 38-38.9° at.....1.01
Somerset (Oct. 25, 1929)†.....
Same as Mid-Continent gravity scale up to and including 38-38.9° at.....1.01

*Posted by Humble Oil & Refining Co. †Magnolia Petroleum Co. ‡Thrall prices same as North Central Texas less 19¼ cents per cwt. freight. §Grayburg Oil & Refining Co., Pioneer Oil & Refining Co. and Texas Petroleum Products Co. ‖Pioneer Oil & Refining Co.

EASTERN STATES
Joseph Seep Purchasing Agency
(Effective April 23, 1931)

Penna Grade Oil in National Transit Lines (Pennsylvania).....$1.78
Pennsylvania Grade Oil in Southwest Pennsylvania Lines (Apr. 27, 1931).. 1.60
Penna Grade Oil in Eureka Pipe Line Lines (West Virginia).....1.50

(Continued on Page 276)

CRUDE OIL GRAVITY TABLE

	1 Oklahoma, Kansas. East Central Texas	2 Oklahoma, Kansas. North Central and East Central Texas	3 East Texas	4 North and Central Texas	5 North Louisiana. Arkansas	6 Carson and Hutchinson Counties, Texas	7 Gray County, Texas	8 Salt Creek, Wyoming	9 Grade B Gulf Coast and Refugio, Texas	10 Stephens, Arkansas
Below 25	...	...	...	...	...	...	...	...	...	...
25 to 25.9	...	...	...	...	...	...	...	...	.60	...
26 to 26.9	...	...	...	...	...	...	...	...	.61	...
27 to 27.9	...	...	...	...	...	...	...	...	.63	...
28 to 28.9	...	...	...	...	...	...	...	...	.65	...
Below 29	.43	.25	.25	.33	.43	...	...	...	...	.38
29 to 29.9	.45	.26	.26	.35	.45	...	...	.45	.67	.41
30 to 30.9	.47	.27	.27	.37	.47	...	...	.47	.69	.41
31 to 31.9	.49	.28	.28	.39	.49	...	...	.49	.71	.41
32 to 32.9	.51	.29	.29	.41	.51	...	...	.51	.73	.41
33 to 33.9	.53	.30	.30	.43	.53	...	...	.53	.75	...
34 to 34.9	.55	.31	.31	.45	.55	.30	.33	.55	.77	...
35 to 35.9	.57	.32	.32	.47	.57	.32	.35	.57	.79	...
36 to 36.9	.59	.33	.33	.49	.59	.34	.37	.59	.81	...
37 to 37.9	.61	.34	.34	.51	.61	.36	.39	.61	...	...
38 to 38.9	.63	.35	.35	.53	.63	.38	.41	...	...	...
39 to 39.9	.65	.36	.36	.55	.65	.40	.43	...	...	...
40 and above	.67	.37	.37	.57	.67	.42	.45	...	...	...

Note—The above prices represented the quotations of the leading purchasers up to the afternoon of June 2, 1931.

Column 1—Carter Oil Co., Humble Oil & Refining Co., Gypsy Oil Co., Gulf Pipe Line Co., Tidal Refining Co., Tidal Western Oil Co., H. F. Wilcox Oil & Gas Co., Pure Oil Co., the last named in the Van, Texas, Pool.

Column 2—Stanolind Crude Oil Purchasing Co., on June 1, followed on same day by Sinclair Refining Co., Barnsdall Refineries, Inc., Mid-Continent Petroleum Corp., Champlin Refining Co., Mid-Kansas Oil & Gas Co., Eason Oil Co., Standard Oil Co. of Kansas, Continental Oil Co., Pure Oil Co., Empire Pipe Line Co., and followed on June 2 by Magnolia Petroleum Co., the latter company, however, paying on lower grades as follows: Below 26 degrees, 23 cents; 26-26.9 degrees, 23 cents; 27-27.9 degrees, 24 cents. Empire Pipe Line Co. adopted Magnolia schedule in Carter County, Oklahoma. The Texas Company met the price in Oklahoma on June 2.

Column 3—Posted on May 26 by Humble Oil & Refining Co., Gulf Pipe Line Co., The Texas Company, Sinclair Refining Co., Magnolia Petroleum Co. and Arkansas Fuel Oil Co.

Column 4—Humble Oil & Refining Co., Gulf Pipe Line Co., The Texas Company and Tidal Western Oil Co.

Column 5—Standard Oil Co. of Louisiana and The Texas Company posted March 10. Standard prices apply to Caddo, Homer, Haynesville, Bull Bayou, Sabine, Crichton, De Soto, El Dorado, Cotton Valley, Sarepta and Carterville.

Column 6—Humble Oil & Refining Co., April 21. Other buyers met price effective April 21.

Column 7—Humble Oil & Refining Co., March 21. Other buyers met price effective April 21.

Column 8—Mid-West Refining Co., March 5, 1931.

Column 9—Humble Oil & Refining Co., March 21. Gulf Pipe Line met price effective April 21.

Column 10—Atlantic Oil Producing Co. and Louisiana Oil Refining Co., March 10, 1931.

CALIFORNIA CRUDE OIL PRICES

(Posted by Union Oil Co. March 30 and the Standard Oil Co. of California March 31)

	Alamitos Hts., Signal Hill, Seal Beach, Torrance, Athens, Rosecrans, Dominguez, Santa Fe Springs, Montebello, Huntington Beach, East Coyote, Richfield, Brea-Olinda	Santa Paula	Orcutt	Coalinga, McKittrick, Kern River, Midway-Sunset, Elk Hills, Buena Vista Hills, Lost Hills
11 to 13.9	....	....	....	$.50
14 to 14.9	$.65	$.60	$.55	.55
15 to 15.9	.65	.60	.55	.55
16 to 16.9	.65	.60	.55	.55
17 to 17.9	.65	.60	.55	.55
18 to 18.9	.65	.60	.55	.55
19 to 19.9	.65	.60	.55	.55
20 to 20.9	.65	.58	.53	.53
21 to 21.9	.62	.56	.51	.51
22 to 22.9	.59	.53	.49	.49
23 to 23.9	.56	.50	.47	.47
24 to 24.9	.53	.47	.45	.45
25 to 25.9	.50	.44	.43	.43
26 to 26.9	.47	.41	.41	.41
27 to 27.9	.44	.38	.39	.39
28 to 28.9	.41	.35	.37	.37
29 to 29.9	.38	....	.36	.35
30 to 30.9	.35	....	....	....

For the time being the Union Oil Co. and the Standard Oil Co. will not post a schedule of crude oil prices for the Playa del Rey and Kettleman Hills Fields.

TANK WAGON MARKETS

Tank wagon quotations for gasoline and kerosene in United States as furnished by the larger marketing concerns June 2

ALL TANK WAGON AND SERVICE STATION QUOTATIONS INCLUDE TAXES

STANDARD OIL CO. (INDIANA)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Chicago	14.0	14.0	3.0	9.0
Decatur, Ill.	14.4	14.4	3.0	9.0
E. St. Louis	13.7	13.7	3.0	8.2
Joliet	14.4	14.4	3.0	9.0
Peoria	14.4	14.4	3.0	9.0
Quincy	14.2	14.2	3.0	8.4
Davenport, Ia.	14.5	14.5	3.0	9.3
Des Moines	14.5	14.5	3.0	9.3
Keokuk	14.5	14.5	3.0	9.3
Sioux City	14.1	14.1	3.0	8.9
Duluth, Minn.	15.5	15.5	3.0	9.9
Mankato	15.1	15.1	3.0	9.7
Minneapolis	15.2	15.2	3.0	9.9
La Crosse, Wis.	16.2	16.2	4.0	10.0
Milwaukee	15.1	15.1	4.0	8.9
Madison	15.3	15.3	4.0	9.1
Detroit, Mich.	14.8	14.8	3.0	10.7
Grand Rapids	14.7	14.7	3.0	10.6
Saginaw	14.9	14.9	3.0	10.8
Evansville, Ind.	15.1	15.1	4.0	8.9
Indianapolis	15.3	15.3	4.0	10.1
South Bend	15.4	15.4	4.0	10.2
Fargo, N. D.	16.9	16.9	3.0	11.0
Huron, S. D.	16.3	16.3	4.0	10.7
Sioux Falls	15.8	15.8	4.0	10.4
K. C., Mo.	13.9	13.9	3.0	7.6
Springfield*	13.9	13.9	3.0	8.5
St. Louis*	13.9	13.9	2.5	8.5
St. Joseph	13.5	13.5	3.0	7.5
Wichita, Kans.	12.8	12.8	3.0	7.8
Bartlesville, Ok.	13.0	16.0	5.0	7.5

*State tax 2 cents, remainder city tax.

A third grade of gasoline, "Stanolind Blue," is sold at all major points at a price 3 cents or more below the price on the regular grade.

Effective April 15—Discounts on Q.D.A. on 1,000 gallons or more per month throughout territory: Red Crown Ethyl gasoline, 3 cents off tank wagon price; Red Crown gasoline, 2½ cents off tank wagon price; Stanolind Blue gasoline, 1 cent off tank wagon price.

Discount in Chicago division on 1,000 gallons or more per month: Red Crown Ethyl gasoline, 4 cents off tank wagon price; Red Crown gasoline, 3½ cents off tank wagon price; Stanolind Blue gasoline, 2 cents off tank wagon price.

Discounts on resellers authorized agent's agreement: Same amounts as above except made off service station price instead of tank wagon price.

PACIFIC COAST TERRITORY

	Gasoline			Kero.
	Wh'la'e price	Retail* price	Incl'ds tax of	tank wagon
Fresno	14.0	11.0	3.0	17.0
San Francisco	14.0	11.0	3.0	15.5
Los Angeles	13.5	10.5	3.0	15.5
Reno, Nev.	22.0	20.0	4.0	19.0
Portland, Ore.	16.5	12.5	4.0	16.5
Seattle, Wash.	16.0	13.0	5.0	16.5
Tacoma	16.0	13.0	5.0	16.5
Spokane	20.0	17.0	5.0	20.5
Phoenix, Ariz.	14.0	15.5	5.0	20.0

Above prices are at company's plant or depots as company does not operate stations. A 6-cent per gallon discount is given dealers and customers taking tank wagon lots except in Phoenix where the discount is 3 cents plus a 2-cent special temporary discount subject to withdrawal at any time.

*Retail prices posted by Standard Stations, Inc., a subsidiary.

SOUTHWESTERN DISTRICT

Magnolia Petroleum Co.

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Dallas, Tex.	13.0	16.0	4.0	8.0
Fort Worth	12.0	14.0	4.0	8.0
Houston	14.0	18.0	4.0	11.0
San Antonio	14.0	18.0	4.0	10.0
El Paso	14.0	18.0	4.0	12.0
Texarkana	16.0	16.0	4.0	11.0
Muskogee, Ok.	13.0	15.0	5.0	8.0
Okla. City	10.0	12.0	5.0	7.0
Tulsa	10.0	12.0	5.0	8.0
Ft. Smith, Ark.	15.0	16.0	5.0	11.0
Little Rock	16.0	16.0	6.0	11.0

One-cent rebate made from posted station prices to cash purchasers in Louisiana, Arkansas and Tennessee.

NEW YORK AND PART OF NEW ENGLAND DISTRICT

Standard Oil Co. (New York)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Albany, N. Y.	16.6	17.6	3.0	15.6
New York*	15.3	15.3	2.0	14.3
Buffalo	15.8	15.8	2.0	14.8
Rochester	16.0	16.0	2.0	14.0
Syracuse	16.8	16.8	2.0	14.8
Boston, Mass.	16.5	16.5	3.0	13.5
Augusta, Me.	18.8	18.8	4.0	14.8
Manch'tr, N. H.	18.4	18.4	4.0	14.0
Burlington, Vt.	19.3	19.3	4.0	15.3

*Prices in steel barrels.

SOUTHERN DISTRICT

Standard Oil Co. (Kentucky)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Atlanta, Ga.	18.0	16.0	6.0	12.5
Augusta	18.0	20.0	6.0	14.0
Macon	18.0	18.0	6.0	13.0
Savannah	13.0	18.0	6.0	12.0
Birm'ham, Ala.	17.0	19.0	5.0	13.0
Mobile	17.0	19.0	4.0	13.0
Montgomery	17.0	17.0	4.0	13.5
Clarks'le, Miss.	18.0	20.0	5.0	13.5
Jackson	16.0	18.0	5.0	11.0
Natchez	18.0	20.0	5.0	13.5
Gulfport	16.0	16.0	5.0	13.5
Vicksburg	16.0	18.0	5.0	11.0
Jack'ville, Fla.	15.0	17.0	6.0	12.0
Miami	18.0	20.0	6.0	13.0
Pensacola	16.0	18.0	6.0	13.0
Tampa	19.0	19.0	5.0	12.0
Lexington, Ky.	17.0	18.0	5.0	12.0
Covington	16.0	17.0	5.0	11.0
Louisville	16.0	17.0	5.0	11.0
Ashland	17.0	19.0	5.0	13.0
Paducah	17.0	18.0	5.0	11.0
Bowling green	19.0	21.0	5.0	14.5
Corbin	18.0	19.0	5.0	15.0

A third grade, "Kyso Green," is sold at a price generally 3 cents below the price on the regular grade.

In addition to the state tax of 4 cents on gasoline, Montgomery has city tax of 1 cent on gasoline and one-half cent on kerosene. Kerosene prices in Georgia include 1-cent tax. In Florida, an inspection fee of 0.125 cent; in Alabama, an inspection fee of one-half cent on kerosene and one-fourth cent on gasoline. To Pensacola, Montgomery, Birmingham and Mobile state taxes add 1-cent levy tax. To Gulfport state tax add privilege tax of 2 cents.

Effective April 2, price to dealers 2 cents under posted tank wagon price.

CENTRAL SOUTH DISTRICT

Standard Oil Co. (Louisiana)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
N. Orleans, La.	15.5	16.5	6.0	13.0
Baton Rouge	15.0	16.0	5.0	12.0
Alexandria†	16.0	17.0	6.0	12.0
Lafayette*	16.0	17.0	6.0	12.0
Lake Charles*	16.0	17.0	6.0	12.0
Shreveport	15.0	16.0	5.0	12.0
Knoxville, Tenn.	17.5	18.5	5.0	13.5
Memphis	13.0	14.0	5.0	10.0
Chatanooga	17.0	18.0	5.0	13.0
Nashville	16.5	17.5	5.0	12.5
Bristol	18.0	19.0	5.0	14.0
Lt. Rock, Ark.	16.0	17.0	6.0	11.0

*Includes city tax of 1 cent. Louisiana kerosene prices include 1-cent state tax. New Orleans kerosene price also includes 1-cent city tax.

†Gasoline price at Alexandria includes 1-cent tax in parish of Rapides.

Two-cent discount off gasoline tank wagon price to dealers and commercial accounts.

NEBRASKA

Standard Oil Co. (Nebraska)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Omaha	13.9	13.9	5.0	9.25
McCook	17.0	17.75	5.0	10.75
Norfolk	16.75	17.75	5.0	9.75
N. Platte	17.75	18.75	5.0	10.50
Scottsbluff	17.0	17.0	5.0	10.25

Note—Dealers' discounts allowed as follows: Red Crown Ethyl, 3 cents off station price; Red Crown, 2½ cents off station price; third grade, 1 cent off station price.

OHIO

Standard Oil Co. (Ohio)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Ohio points*	15.0	16.0	4.0	†13.0

*Dealers and commercial accounts 2 cents under tank wagon.

†Service station price 14 cents.

NAPHTHA

	Tank wagon	Tank car
Oleum spirits	12.0	8.0
V.M.&P. naphtha	14.0	9.5
Cleaners' naphtha	16.2	11.0
Stanisol	16.2	11.0

Tank wagon prices f.o.b. Chicago; tank car prices f.o.b. Whiting.

STANOLIND FURNACE OIL IN CHICAGO

All dumps of 50 gallons or more..... .07

Note—Outside Chicago furnace oils discount of 1 cent per gallon is given on deliveries of 100 to 349 gallons and 1½ cents on deliveries of 350 gallons or more.

PENNSYLVANIA-DELAWARE AND PART OF NEW ENGLAND

Atlantic Refining Co.

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Pittsburgh, Pa.	*12.0	*14.0	...	12.0
Philadelphia	*12.0	*14.0	...	12.0
Scranton	*12.0	*14.0	...	12.0
Allentown	*12.0	*14.0	...	12.0
Altoona	*12.0	*14.0	...	12.0
Erie	*12.0	*14.0	...	12.0
Dover, Del.	15.0	17.0	3.0	12.0
Wilmington	15.0	17.0	3.0	12.0
Springf'd, Mass.	14.5	16.5	3.0	11.0
Fall River	14.1	16.1	...	11.0
Worcester	14.3	16.3	3.0	11.0
Boston	13.5	15.5	2.0	11.0
Providence, R.I.	13.7	15.7	3.0	11.0
Hartford, Conn.	14.5	16.5	2.0	10.0
New Haven	14.6	16.6	2.0	10.0

*Does not include tax of 3 cents in Pennsylvania. Pennsylvania tax is collected by the dealer and paid by him direct to the State. Atlantic Refining Co. recognizes a 2-cent per gallon discount on gasoline from its posted tank wagon markets on sales to dealers for purpose of resale. Atlantic Refining Co. also recognizes a maximum discount of 2 cents per gallon on gasoline to commercial accounts under contract for one year.

ATLANTIC COAST DISTRICT

Standard Oil Co. (New Jersey)

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Atl'tic City, N.J.	13.7	15.7	3.0	11.5
Newark	13.7	14.7	3.0	10.5
Annapolis, Md.	15.2	16.2	4.0	11.0
Baltimore	14.4	15.4	4.0	8.5
Cumberland	16.2	17.2	4.0	12.0
Wash'gton, D.C.	12.9	13.9	3.0	10.0
Danville, Va.	17.0	18.0	5.0	11.5
Norfolk	15.5	16.5	5.0	10.0
Petersburg	16.5	17.5	5.0	11.2
Richmond	15.9	16.9	5.0	10.7
Roanoke	17.2	18.2	5.0	12.0
Charles'n, W.Va.	15.7	16.7	4.0	11.5
Keyser	16.3	17.3	4.0	12.1
Parkersburg	14.4	15.4	4.0	10.2
Wheeling	15.6	16.6	4.0	11.4
Charlotte, N. C.	15.5	19.5	6.0	11.0
Hickory	15.8	19.8	6.0	12.4
Mt. Airy	15.7	19.7	6.0	12.5
Raleigh	15.4	19.4	6.0	12.2
Salisbury	15.7	19.7	6.0	12.5
Charleston, S.C.	16.5	17.5	6.0	10.3
Columbia	15.4	19.4	6.0	12.2

A 2-cent per gallon discount off the gasoline tank wagon price is offered to dealers, except in Washington, D. C., and in Maryland where discount is 3 cents.

ROCKY MOUNTAIN DISTRICT

Continental Oil Co.

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wagon
Denver, Colo.	15.0	18.0	4.0	12.5
Pueblo	14.0	17.0	4.0	12.0
Grand Junction	16.0	19.0	4.0	14.5
Casper, Wyo.	15.0	18.0	4.0	10.0
Cheyenne	16.0	19.0	4.0	11.5
Butte, Mont.	17.0	20.0	5.0	16.0
Billings	20.0	23.0	5.0	14.5
Great Falls	20.0	23.0	5.0	16.0
Helena	20.0	23.0	5.0	16.0
S'lt Lake, Utah	17.5	20.5	4.0	16.0
Albu'que, N. M.	16.0	20.0	5.0	14.0
Boise, Idaho	18.0	21.0	5.0	13.0
Twin Falls‡	20.5	....	5.0	18.0

‡Less 3½ cents.

TANK WAGON CHANGES

Standard Oil Co. of Nebraska advanced the gasoline tank wagon and station prices 1 cent on May 3 to equalize the increase in the state tax from 4 to 5 cents.

Standard Oil Co. of California reduced the gasoline wholesale price to 20 cents in Spokane, Wash., and the retail to 17 cents May 26. On May 29 the wholesale price was reduced to 14 cents and the retail price to 15½ cents in Phoenix, Ariz.

Magnolia Petroleum Co. reduced kerosene to 8 cents in Dallas May 5 and in Fort Worth May 14, and to 7 cents in Oklahoma City May 15. The gasoline station price was increased 1 cent to 12 cents in Tulsa and Oklahoma City May 15 and was reduced 1 cent to 15 cents in Muskogee May 25. On May 20 the gasoline tank wagon and station prices were reduced one-half cent to 15 cents and 16 cents in Fort Smith, Ark. On May 26 these prices were reduced to 16 cents each in Little Rock, Ark.

CRUDE OIL PRICE CHANGES

On June 1, the Stanolind Crude Oil Purchasing Co. reduced the price it pays for Kansas, Oklahoma, North Central Texas and East Central Texas crudes, applying the East Texas prevailing price schedule. Starting at 25 cents for oil below 29 gravity, it posted a 1-cent increase for each degree upward to 40° and over at 37 cents. The Champlin Refining Co., Eason Oil Co., Mid-Kansas Oil & Gas Co., Standard Oil Co. of Kansas, Pure Oil Co., Empire Pipe Line Co., Mid-Continent Petroleum Corp., Continental Oil Co. adopted the new schedule on June 1 and the Magnolia Petroleum Co. on June 2, the latter company, however, making its own prices for low gravity oils as follows: Below 26 °, 22 cents; 26-26.9° 23 cents; 27-27.9°, 24 cents. The Empire Pipe Line Co. then applied the Magnolia's lower gravity prices to oil it purchases in Carter County, Oklahoma. The Texas Company met the prices in Oklahoma on June 2.

The Vacuum Oil Co. on June 1 posted a flat price of 60 cents per barrel for Grade A oil and 55 cents for Grade B oil in the Lockport, Louisiana Field.

The Pure Oil Co. on June 1 posted 52 cents per barrel for Midland, Mich., crude oil. In the Muskegon Field in Michigan, on June 1 the Stanolind Crude Oil Purchasing Co.'s Mid-Continent prices were made applicable by the Standard Oil Co. of Indiana.

AUTOMOBILE PRODUCTION UP

Automobile production in the United States during April, based on factory sales of 144 manufacturers, amounted to 335,708 vehicles, an increase of 59,303 vehicles over the output of the previous month, the Census Bureau announced.

ARGENTINE REFINERY PERMIT

The provisional government of Argentine has granted a permit to The Texas Company to build a refinery. The company has no plans to build a refinery in the near future, but will install a terminal for the distribution of petroleum products to Buenos Aires.

CRUDE OIL PRICES

(Continued from Page 275)

Penna Grade Oil in Buckeye Pipe Line Lines (Ohio) (Sept. 14, 1930)	1.25
Corning Grade Oil in Buckeye Pipe Line Co.'s Line (Mar. 11, 1931)	.80
Ragland Grade Oil in Cumberland Pipe Lines (Kentucky)	1.10
Wayne District Oil in Cumberland Pipe Lines	1.17

Tide Water Pipe Co.

Bradford district (Apr. 23, 1931)	$2.00
Allegany district (Apr. 23, 1931)	2.00

Pure Oil Co.

Cabin Creek, W. Va. (Apr. 23, 1931)	$1.50
Kelly Creek, W. Va. (Apr. 23, 1931)	1.50
Bradford Hollow, W. Va. (Apr. 23, 1931)	1.50

MIDDLE WESTERN STATES

Ohio Oil Co.

(Effective March 6, 1931)

Lima	$ .90
Wooster	.99
Illinois	.80
Indiana	.50
Princeton	.80
Plymouth	shut in
Western Kentucky	.75
Midland, Mich.* (June 1, 1931)	.53
Dundee, Mich. (Oct. 26)†	
Same as Stanolind Crude Oil Purchasing Co.'s Mid-Continent gravity scale.	
Upper and Lower Traverse Sands, Mich.	
.....Same as Mid-Continent gravity scale	
Cumberland, Clay, Barren, Clinton and Monroe Counties, Kentucky (Oct. 28)‡	.85
Oil City, Ky. (Apr. 1, 1931)§	.60
Oil Springs (Canada) (Oct. 28)¶	1.57
Petrolia (Canada) (Oct. 28)¶	1.50
Alberta (Canada)‖:	
50° and above (Mar. 1, 1931)	2.36
45 to 45.9° (Mar. 1, 1931)	1.87

*Posted by Pure Oil Co. †Posted by Standard of Indiana for boat shipment. ‡Posted by Paragon Development Co. §Posted by Stoll Refining Co. ¶Posted by Imperial Oil, Ltd. ‖Posted by Imperial Oil, Ltd., and Regal Oil & Refining Co. of Calgary.

MEXICAN CRUDE

Panuco*	$ .46

*F.o.b. ship, based on April transactions and exclusive of taxes and bar dues.

Of Interest to Sales Departments

Engineers Discuss Future of Diesel Engines for Cars

The pro and con of the Diesel engine both as to the present and future was the subject of discussion at a recent meeting of the Society of Automotive Engineers. Proponents of the Diesel engine for vehicles and airplanes disputed every statement made against the engine by those who do not feel that it can replace the gasoline engine. Following are some of the statements made at the controversial meeting:

It seems that fuel economics provide no legitimate incentive for developing the Diesel-type of engine; the price differential between gasoline and fuel oil will vanish when the demand for fuel oil increases. . . . That with no differential existing between light and heavy fuels, possible savings in fuel cost for a given output fully justify the development of Diesel engines for automotive use.

That Diesels are very sensitive as to fuel requirements and that a narrow range of fuel specifications must apply in the preparation of fuel for a given engine type. . . . That Diesels will accept and digest without complaint almost anything from alcohol to asphalt.

That Diesels are particularly well adapted to marine and aircraft use because the heavier fuels eliminate fire hazards. . . . That fuel oil for aircraft and marine Diesels is difficult to handle properly to prevent creeping which results in the promotion of burning of parts that are covered by it.

That Diesel engined aircraft may deny the pilot the privilege of landing whenever piston leakage allows oil to be pumped from the crankcase and burn in the cylinders; the pilot in this dilemma must remain in the air until his crankcase is drained. . . . That this condition can easily be remedied and that no difficulty from this cause need ever exist.

Bad Smokers

That Diesels are bad smokers, the smoke having a very disagreeable acrid odor. . . . That Diesels, properly operated, smoke less than conventional gasoline engines and the exhaust is sweet and clean.

That valves, jets and pumps on Diesels are, and are inherently, sources of continual trouble and need frequent attention. . . . That these elements are operating, day in and day out, without attention for thousands of hours and need no more nursing than a set of spark plugs.

That Diesels must of necessity cost more to build. . . . That Diesels in quantity production will cost practically no more than the conventional engine to build. That Diesels must be much heavier for a given rating. . . . . That Diesels for a given rating are no heavier.

That present automotive Diesels have all the desirable performance characteristics of gasoline engines and some in addition. . . . That present automotive Diesels lack flexibility and do not perform properly over a desirable speed and load range.

That Diesel development, as now in progress, is up the wrong track and cannot possibly result advantageously. . . . That present day development of Diesels has a clear course ahead and that the final result will be a happy blending of features that now characterize the Diesel and conventional gasoline engine.

That automotive "Diesels" are not Diesels at all; there is no such thing today in operation as a real automotive Diesel engine.

QUALITY OF CANADIAN GASOLINES SHOWS UP WELL IN ANNUAL SURVEY

Gasolines of relatively high quality are being marketed in Canada according to the 1930 survey of gasoline quality, made by the Department of Mines. The survey was made last August and the results, recently completed and analyzed, are based on samples collected from 13 widely scattered cities in Canada. One hundred twenty-four samples were tested. While the quality of the group was high, there was a wider variation among the samples than in 1929.

The average of the group proved better than the average of the gasoline sold in the United States in July, using the United States Bureau of Mines report as the basis.

No material change was noted in the distillation points above 50 per cent but the initial, 10 per cent and the 20 distillation points show a marked drop compared to the gasoline sold only a few years ago.

The tests on the samples collected have been averaged and the following results will permit a comparison with past years:

District—	I.P. °F.	Per cent distilled— 10%	20%	30%	70%	90%	E.P. °F.	Recovery	Gr. A.P.I.
Canada, 1916	125	170	192	237	270	330	380	....	61 8
Canada, 1923	120	170	193	255	296	358	423	97.1	60.5
Canada, 1924	113	173	195	249	288	347	410	97.4	60.8
Canada, 1925	116	174	199	258	299	359	412	97.0	60.0
Canada, 1926	110	164	191	256	300	360	410	97.4	60.0
Canada, 1927	107	161	189	259	304	366	416	97.0	59.5
Canada, 1928	107	160	186	255	298	359	409	97.3	60.5
Canada, 1929	102	153	181	255	300	363	411	97.0	60.8
Canada, 1930	101	155	182	254	301	362	406	97.2	59.5
United States, July, 1929	102	... 122	187	263	...	378	410	96.1	57.7
U. S. Federal Specification (Revised June 11, 1929)	...	to 176	...	284	...	392	437	95.0	....

"TOURS AND DETOURS" MAKES ITS APPEARANCE

NEW YORK, June 1.—Standard Oil Co. of New York has started publication of "Tours and Detours," a new semi-monthly publication, containing much touring information, up-to-the-minute road maps, and handsomely illustrated with views of scenic and historic importance in "Soconyland."

In a statement in connection with the new publication, H. L. Pratt, chairman of the board of the New York company, says: "With this, the first issue of 'Tours and Detours,' a new service is offered to the motoring public.

"As the name implies, the purpose of this service is twofold. First, to add to your enjoyment of motoring by suggesting places in New York State and New England which are worth visiting for their scenic, historic or human interest. And to provide you with accurate and up to date information which will help you to avoid roads under repair.

"'Tours and Detours' will be published on the first and fifteenth of each month from June to August inclusive. You can obtain it without charge at all Socony service stations.

"If this new service provides the incentive whereby you and your family may derive greater pleasure from the use of your car it will have accomplished its purpose."

FIVE-CENT TAX PAYS LESS

The 5-cent gasoline tax in Oklahoma paid the state treasury $118,000 less in May of this year than the 4-cent tax a year ago. This fact has caused the tax department to lay the blame on tax evaders. That tax evasion has become a general practice among the poorly established marketers in certain sections has been recognized for some time. The larger marketing companies have sought relief from the State from time to time because these represented a difficult type to compete with in the marketing of refinery products. It is believed that more concerted action will result now since the state revenues have been adversely affected.

MAY DROP BILLBOARDS SOON IN WASHINGTON

WASHINGTON, D. C., May 29.—An attempt is being made to eliminate advertisments by oil companies using billboards in the District of Columbia and along highways within 20 miles of the district boundary lines. This movement is of general interest to the oil industry as it is regarded as a forerunner of a similar policy that may be put into effect by many large cities seeking to improve the scenic effects along public highways by which they are approached.

Encouraged by the attitude of some of the large oil interests, the American Civic Association has submitted a proposed form of agreement to 12 national oil companies using billboards in the Washington area to gain co-operation in restricting the number of signs on the highways.

The step was prompted largely by the attitude of W. C. Teagle, president of the Standard Oil Co. of New Jersey. In response to a protest against defacement of the landscape received from a member of the national capitol committee of the association, Mr. Teagle had written: "If we have billboards outside of the district which are a defacement, I am sure we will want them removed. We do not own any of these boards, and I am asking that a survey be made to determine our position.

"We have abandoned pians for an economical structure on Pennsylvania Avenue and will build an architectural monument. We wish to have all in accord with plans for the new nation's capitol."

Coincident with the issuing of letters to the heads of the 12 oil companies, announcement was made through the Evening Star that the Gulf Refining Co. of Pittsburgh, Pa., had decided to transfer its billboards on all main highways in the Washington area to locations which would be unobjectionable.

PETROLEUM REPRESENTATIVE

Walter L. Meyers has been appointed general petroleum representative for the M. K. & T. Railroad with headquarters in Tulsa. The position is new for the Katy Railroad. Mr. Meyers, who has been connected with the Katy Railroad for several years, will devote his entire time to co-operating with oil companies in the shipment of petroleum products.

NEW "SINCLAIR GREEN" AS COMPETITIVE GRADE

NEW YORK, May 29.—Effective today, Sinclair Refining Co. is introducing into New York and other eastern markets "Sinclair Green," described as a third-grade gasoline produced to sell on a competitive basis. Prices for the new product are scheduled to average 3 cents per gallon under the posted levels for the regular grades.

"Sinclair Green" was developed to give the Sinclair organization a gasoline to sell on a price basis in sections of its territory where the competition afforded by relatively low grades of motor fuel has been particularly keen. During recent weeks, Sinclair has introduced this product into 465 cities and towns where marketing conditions have been highly competitive, and in the 18 states in which the "green" gas has already been placed on sale, the company has been successful in picking up considerable gallonage which had been lost to the price cutters.

While the selling price of the third-grade gasoline will average 3 cents under the market for "regular" grades, the company's marketing plan contemplates the sale of "Sinclair green" at as much as 5 cents per gallon under top grades wherever necessary to meet particularly stiff local competition.

The product has been placed on sale this week in New York City and suburbs and numerous points in New Jersey. Marketing of the "Sinclair green" originated in the Mid-West, and it is now being sold in 107 cities and towns in Iowa; 82 in Kansas; 55 in Missouri; 51 in Illinois; 49 in Minnesota; 35 in Michigan; 33 in Indiana; and 23 in Wisconsin.

"Sinclair green" will not be sold at all stations, it is indicated, but will be marketed particularly at company stations where nearby price cutting has tended to depress sales.

RUSSIA RECAPTURES SPANISH OIL OUTLET

NEW YORK, May 31.—The new Republican government of Spain has cancelled the Spanish Petroleum Monopoly's contract for petroleum supplies from Rumania, made under the monarchist regime of King Alfonso, and has reawarded the contract to the Soviet Naphtha Syndicate, according to cable advices received here.

The contract, which calls for approximately half of Spain's annual requirements of gasoline and other refined petroleum products, was formerly held by Russia and was taken by Rumania several months ago, covering 1931 purchases with a two-year renewal provision.

The change in government in Spain is not expected to affect American oil exports to that country. Among the principal American sellers of oil products to the Spanish Petroleum Monopoly are Cities Service Export Co. and the American Republics Corp.

TAX FILLING STATIONS

INDIANAPOLIS, Ind., June 3.—Since the so-called 1929 Indiana "chain store tax" provides for payment by all institutions doing a "wholesale or retail business" in the State, the broadest interpretation will be put on the law by state tax commissioners, James Showalter, chairman of the Board of Taxation, stated. "So far as we can interpret the law," he said, "filling stations and all other business must pay the tax."

DOHERTY'S METHOD OF MAXIMUM EFFICIENCY IN PRODUCING OIL

By Charles E. Kern
Washington Bureau, The Oil and Gas Journal

WASHINGTON, D. C., June 1.—Claims of Henry L. Doherty for a patent on a method by which the level of an oil body remains constant through securing such a ratio between the pressure of the water below and the gas or air pressure above the oil body as to secure practically the same rate of flow of oil from the wells until the oil body is practically exhausted has been allowed by the United States Court of Customs and Patent Appeals.

This decision reverses a decision by the board of appeals of the United States Patent Office affirming a decision of the examiner rejecting all of the claims of the appellant's application.

The appellant, Henry L. Doherty, also appealed from the decision below contained in his claim 11 for a method of developing new oil fields comprising: Determining the location boundary of an underground oil body; maintaining a body of gas above and in contact with the oil body under sufficient pressure to prevent oil from passing up into unwetted sand; extending oil wells into the oil body, and forcing oil from the oil body out through the wells by raising the level of a body of water below and in contact with the oil body. This claim was rejected by the board of appeals and its decision is now affirmed by the United States Court of Customs and Patent Appeals.

These decisions terminate litigation that has covered considerable time, and, while an appeal to the United States Supreme Court is allowable, opinion expressed here is against the probability of such a course. It is believed this decision will end this dispute over the Doherty application for a patent.

The appellant took an appeal to the court from the rejection of four claims, numbered 3, 7, 11 and 13. Claims 3 and 7 were allowed and Claims 11 and 13 were disallowed in this final contest before the court. Claims 3 and 11 are illustrative of the claims in issue and read as follows:

Claims 3 and 11

Claim 3—A method of developing an oil field as a unit comprising determining the location boundary of an underground oil body, maintaining the oil in its original position in the oil sand by holding a body of gas above the oil body under sufficient pressure to prevent oil from passing up into unwetted sand, extending oil wells into the oil body and forcing oil from that body out through the wells by raising the level of a body of water below the oil body and maintaining sufficient back pressure on the oil flowing through the wells to hold the oil body under substantially its natural pressure.

Claim 11—A method of developing new oil fields comprising determining the location boundary of an underground oil body, maintaining a body of gas above and in contact with the oil body under sufficient pressure to prevent oil from passing up into unwetted sand, extending oil wells into the oil body, and forcing oil from the oil body out through the wells by raising the level of a body of water below and in contact with the oil body.

Invention Described

The claimed invention is described by the examiner in his decision as follows:

"The invention relates to a process of development and exploitation of oil fields. In many fields the gas is entrapped above the oil at an upper part of a dome, such dome at the upper part thereof being filled with very porous sand and gas, free of oil, constituting the region of 'unwetted sand' of this application.

"If a well is drilled in the region of the gas entrapped, the gas rushes out to the surface without performing the useful function of propelling the oil, dissolving therein and thereby lowering the specific gravity of the oil, as also forming bubbles in the body of oil in the process of comingling therewith and thereby assisting the further elevation of the oil to the surface in a manner well understood in the art.

"If an oil well should be drilled in the region of the oil, the gas pressure will be instrumental in elevating the oil through the well until the level of the oil will become sufficiently low and an open passage from the region of the gas to the mouth of the oil well will be formed, and the rest of the gas in the dome will rush out from the oil well without performing any useful function.

"The objects of this invention is to remedy the phenomenon described above and it proposes to drill three wells or three series of wells.

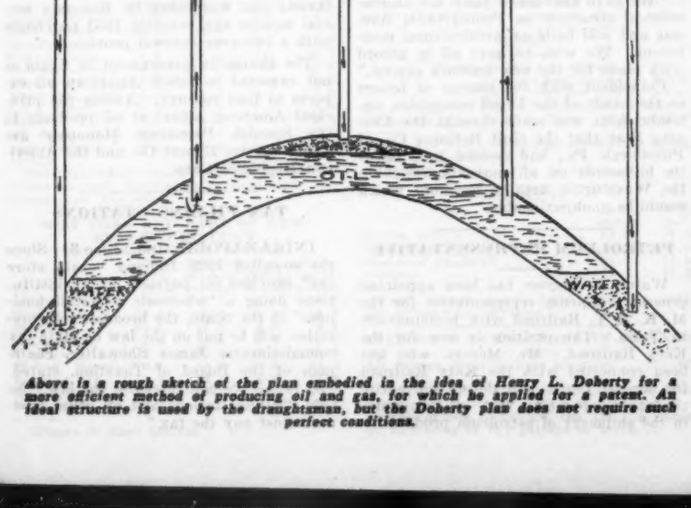
"One well, or a series of wells, will be located in the region of the gas at the apex of the dome and are designated with the reference character 10 on the accompanying illustration showing different formations of the oil-bearing sands; the second well, or series of wells, will be located without the region of the gas and within the region of the oil and are designated with the reference character 12; the third well, or a series of wells, will be drilled without the region of the oil and these last wells will be extended into the formation so as to reach the region below the oil and these wells are designated with the reference character 14.

Water is introduced into the wells (14), oil under control is removed from the wells (12) and the wells (10) are utilized for introducing artificial gas pressure should the natural pressure in the dome become too low.

"The rate of removing the oil from the wells (12) and that of introducing into the wells (14) is such that the oil in the oil region remains above the level of the lower termination of the wells (12), the water introduced elevating the oil so as to keep the level of the oil above these lower terminations of the wells (12) so that the pressure existing in the region of the dome, or introduced therein, shall be operative in elevating the oil through wells (12) and thereby only the gas dissolved and comingled with the oil will find its way out of the wells (12) and on its way out will perform the useful function of elevating the oil to the surface, the free gas in the dome being sealed off by the oil which is kept at a sealing level by the water being introduced through the wells (14)."

Further Claim

Appellant in his brief concedes that the above quotation correctly describes the invention claimed except that it fails to point out that his process contemplates displacing oil from the field by water while holding the upper level of the oil body substantially stationary so that oil will not enter the unwetted gas sand overlying the oil and be lost by absorption in and adsorption with the dry gas sand. We agree with appellant's counsel that said feature is disclosed by appellant's specification.



Above is a rough sketch of the plan embodied in the idea of Henry L. Doherty for a more efficient method of producing oil and gas, for which he applied for a patent. An ideal structure is used by the draughtsman, but the Doherty plan does not require such perfect conditions.

CRUDE OIL PRICES ARE BELOW LIFTING CHARGES

(Continued from Page 19)

gas is produced in paying quantities. This department is willing to co-operate as far as possible in the matter of the protection of its leases and the Indian land owners and in conserving the deposits of oil and gas which may be extracted through such wells. It is suggested that applications be forwarded to us through the superintendent of the local Indian agencies in any cases where it is desired to close in small producing wells temporarily; such applications if submitted will be considered with a view to reaching a practical solution of the situation.

"Sincerely yours,
(Signed) "RAY LYMAN WILBUR,
"Secretary."

Costs vs. Price

The Secretary of the Interior is by this time aware that many thousands of wells on Indian lands are a liability to their owners. The cost of lifting the oil, which costs include only the actual lease expenses: fuel, labor and field supervision, and do not include the numerous higher administrative and executive charges, or taxes, depreciation, depletion, etc., range from 15 cents to $1.22 per barrel. For example it costs $1.08 per barrel to lift 533 bbls. of oil in 17 wells on one property in Okmulgee County. The total lifting charge is $575.64 and the production at the present market will sell for $186.55. This is an unusual case, yet the same company's entire production in the Okmulgee County is subject to an average lifting charge of 35 cents per barrel which is exactly the price the company will receive for the oil. One oil company with many leases in various parts of the State including the semi-flush Seminole Field, has an average lifting charge of 29 cents per barrel, while the crude sells for an average 34 cents per barrel. The 5-cents-per-barrel "profit" goes a very little way toward paying the thousand and one items of executive and general administrative expense to which this or any other oil company is subjected.

Here are a few items comparing lifting charges with present-day prices for the oil brought to the surface, the first figure representing the lifting charge and the second the Stanolind's new posted price: Bartlesville area, $1.28 as against 28 cents, a loss of $1 per barrel; Bigheart, Osage County, 56 cents as against 30 cents, a loss of 26 cents per barrel; Bird Creek, 48 cents as against 29 cents, a loss of 19 cents per barrel; Flat Rock, 47 cents as against 29 cents, a loss of 18 cents per barrel; Bristow, 53 cents as against 30 cents, a loss of 23 cents per barrel; Seminole area, 30 cents as against 36 cents, and this in a field that has not reached a settled production stage; Wetumka, 73 cents, as against 34 cents, a loss of 39 cents per barrel; Walters district, in the southern part of the State, 48 cents as against 33 cents, a loss of 15 cents per barrel.

In western Kansas in the flush production area the lifting cost is about 9 cents per barrel. In Cowley County, however, the costs mount to 24 cents and in the old eastern Kansas fields, where the new price is 25 cents per barrel, the lifting charge is above 50 cents per barrel, excepting on those leases operated by their owners who do all the work required and do not charge their time.

The Blackwell Oil & Gas Co., which operates in the Seminole, Kay County and other fields in Oklahoma, reports an average of 34 cents per barrel lifting charge on 38 leases ranging from a low of 3 cents per barrel to a high of 83 cents per barrel. Its average of 34 cents does not more than represent the present market price for the weighted average production of the company on a gravity basis.

Over in the Texas Panhandle a representative property shows a lifting charge of 27 cents per barrel. In the Wichita Falls district the lifting charge averages 4 cents under the market price of the oil.

Gigantic Economic Waste

The clamor of a group of short-sighted East Texans, persistently maintained, has had its effect. If the Stanolind's prices are generally adopted, over 1,000,000 bbls. of oil will go to market daily at an average of 35 cents per barrel. It may be that later in the summer East Texans will be lucky if they get 15 cents a barrel. Deluded farmers who listened to badly informed antiprorationists will eventually find that they have thrown away an opportunity to build up a snug fortune by permitting their oil to be produced at a time when there is twice as much oil in sight as the market required and permitting it to be sold at one-third of what they could have got for it if the oil had been kept in the ground until needed. The law of supply and demand is working with a vengeance. If the East Texas policy is kept up and the field is permitted to produce to capacity it will be at a price at which no producer will make money and the royalty owners will be counting dimes instead of dollars.

The Magnolia Petroleum Co., followed by the Humble Oil & Refining Co., The Texas Company, the Gulf Refining Co., the Arkansas Fuel Oil Co. and the Sinclair Refining Co. gave East Texas operators an opportunity to make money on their production by posting the regular Mid-Continent price there, expecting that in turn East Texas would curtail their production to current crude requirements. The Texas Railroad Commission placed a 160,000-bbl. limit to the daily production, but little attention was given the commission or its field staff of umpires and assistants. Operators continued to bring in wells as fast as they could be put down and to sell their crude at prices far below the posted price of the larger companies. Seeing the futility of their efforts, the big companies cut the price about 30 cents per barrel. This had no effect on East Texas operators.

May Speed Legislation

Every effort will be made to prevail upon the governor of Texas to call a special session of the state legislature and to show legislators the absolute need of passing legislation that can be put into effect at once and which will give the State the widest police powers to curtail the flood of useless oil now pouring out of the East Texas Field. If it happens that the legislation is not forthcoming, it seems evident that the oil purchasing companies will give in to the East Texans and lay pipe lines into the field of such capacity and in such number that all the oil produced can be carried away at prices the East Texans appear to be willing to take. It requires no stretch of the imagination to envision a 10-cent

market in that territory. It will be tough on all the other fields in the country but it will get East Texas out of the picture and clear the way for better conditions. Already North Texas operators are planning to temporarily shut in their wells, and with the assistance of the Department of the Interior Oklahoma operators may be able to do likewise. Undoubtedly many Kansas operators will refuse to sell oil at a great loss.

On Monday, June 1, the Pennzoil Co. of Oil City, Pa., a subsidiary of the South Penn Oil Co., one of the Standard oil group, announced that it would pay $1.90 per barrel for Pennsylvania grade oil in the vicinity of Oil City to producers signing a year's contract. This is 15 cents over the posted price for oil bought by the South Penn Oil Co. and run through National Transit lines.

On June 2 the Pure Oil Co. reduced Midland, Mich., crude to 52 cents per barrel, a 23-cent cut. The Standard Oil Co. of Indiana buying in the Muskegon, Mich., Field, pays the Stanolind Crude Oil Purchasing Co.'s Mid-Continent prices for Dundee crude.

TO SPEED TEXAS SUITS TESTING PRORATION LAW

AUSTIN, Tex., June 2.—Agreement was reached at a conference between Governor R. S. Sterling, members of the Railroad Commission and a representative of the Attorney General's department to speed the suits filed to enjoin enforcement of the Railroad Commission's oil proration orders.

Governor Sterling said the Attorney General would get behind the suits and push the court for a decision. Ten suits to restrain the commission from enforcing proration in East Texas have been filed in the Travis County District Court.

Attending the conference were C. V. Terrell, commission chairman, and Pat M. Neff and Lon A. Smith, commissioners, with R. D. Barker, chief oil and gas supervisor.

It was believed a speedy court decision would clear the situation so definite action could be taken. Should the courts decide the commission did not have authority to enforce its orders it was regarded as highly probable the governor would call a special session at which it would be sought to give the commission this authority.

TAX CONFERENCE PROPOSED

The calling of a conference of Federal and state tax officials to co-ordinate Federal, state and local tax systems was proposed to President Hoover by tax officials of New York, Illinois and Massachusetts who conferred with him at the White House. These officials were Mark Graves, tax commissioner of New York; H. S. Hicks, tax commissioner of Illinois; and Henry Long, tax commissioner of Massachusetts. The President has taken the request under advisement.

TIDE WATER IN CANADA

CHATHAM, Ontario, May 30.—Official announcement is made that the Tide Water Oil Co. of Canada, Ltd., with head offices at Hamilton, Ontario, has been incorporated. The newly formed company will market Veedol motor oils and greases and other Tide Water products through distributors in the various Canadian provinces.

JOINS ARTHUR G. McKEE & CO.

Frederick W. Stone, consulting petroleum engineer, of Tulsa, has joined the engineering staff of Arthur G. McKee & Co., of Cleveland, Ohio. Mr. Stone and family sailed from New York on the S. S. Europa May 2 for Bremen, Germany. Mr. Stone will supervise the construction of a refinery at Hanover, Germany, which the company is building for Gewerkschaft Elwerath.

BUREAU OF MINES STUDYING FLOW OF GAS THROUGH HIGH-PRESSURE LINES

By W. B. Berwald
United States Bureau of Mines, Bartlesville, Okla.

The Bureau of Mines, in co-operation with the Natural Gas Industry of the American Gas Association, has been studying actively for the past several years the problem of the flow of natural gas through high-pressure transmission lines. Numerous data on gas flow through pipe lines under many conditions of operation have been obtained by carefully conducted tests, and these data, together with all other available information have been analyzed carefully to secure practical facts for the use of engineers in designing pipe lines and analyzing the effects of different operating conditions on pipe line capacities.

The nature of the investigative work has been primarily an engineering study of flows through commercial pipe lines and a comparison between the actual observed flows and those obtained by the application of the various pipe line flow formulas.

A comprehensive detailed report of the investigation is now in the process of publication. Briefly this report will contain the following data and conclusions:

1. A description of the procedure which was planned for the investigative studies by the pipe line flow committee, and how this procedure has been followed in general throughout the progress of the investigation.

2. A discussion of the pipe line flow formulas that have been in use in the industry. The survey showed 10 formulas have had more or less common use in the past. These formulas when applied to any one set of flow conditions were found to give widely varying results, in certain instances this variation was as much as 30 per cent.

3. The extent and procedure of making pipe line flow test is given. The 29 commercial transmission lines that have been tested total 757 miles of pipe varying from 6 to 22 inches in diameter and include lines in most of the major gas areas of the country.

Factors Affecting Flows

4. A careful study and analysis was made of all factors affecting the flows on individual lines. These factors consist not only of actual measurements during tests, but also condensates and sediments, construction features, fittings on the line, elevation differences, leakage conditions and effects of storage and drainage.

5. It has been observed, that, with conditions of steady flow and no obstructions in the line, such as condensates, sand or rust, the measured rates of delivery agreed more closely with the rates calculated from Weymouth's formula than with those calculated from any of the other formulas, and in almost every test, under these conditions, the results calculated from Weymouth's formula were within a few per cent of the measured delivery.

6. The description, test data and results for each line is given as completely as possible in a tabulated form. This is followed by a more detailed discussion and analysis of the results on each line.

7. A discussion of the relation between the coefficient of friction and internal diameter of the pipe, based upon the actual flow tests, is given. The actual coefficient of friction tends to decrease slightly with increasing diameter of pipe. The observed relation was found in close agreement with that expressed by the Weymouth formula over the range of pipe diameters tested.

8. Further analyses show a small variation of the coefficient of friction with changes of gas density. For constant velocity conditions the coefficient of friction decreased slightly with increased density.

Reynolds Criterion for Fluid Flows

9. The relation between the coefficient of friction and the Reynolds criterion for fluid flows is discussed. A curve of the experimental results is plotted on this basis and indicates that the relation of the Reynolds criterion to the coefficient of friction does not give sufficiently consistent results over the wide range of conditions encountered in natural gas flows to permit its unqualified use. The Reynolds criterion of the coefficient of friction is taken as the ratio of the pipe diameter, velocity and density to the viscosity of the gas.

10. Condensates in a pipe line decrease the capacity of the line to deliver gas. Rust and corrosive action on the interior walls of the pipe as well as the presence of any foreign material in the line also decrease the capacity of the line. Considerable discussion is given to the effect of these factors on lines especially selected for this purpose.

11. Tests have been made on small experimental pipe lines where the diameter of the pipe increases in the direction of the flow. The results of these tests indicate that a slight advantage is obtained when the flow is in the direction of increasing diameter, that this advantage is due only to the number and diameter ratio of the swedges used to change the diameter of the line.

12. A table of the chemical composition of the gases encountered in the pipe line tests is given and a brief discussion of the compressibility and viscosity of these gases. Experimental laboratory determinations of these physical properties of the gases have been made and the methods and results of these determinations given in the report.

Accuracy of Weymouth Formula

Results of the investigation point out that: The Weymouth pipe line flow formula, over a wide range of pipe line flow conditions, gives flows sufficiently close to the actual deliveries for all practical purposes of pipe line design and operation. There are slight variations in the coefficient of friction which are not fully cared for in any one formula. These variations are ordinarily quite small and to include corrections for them in a flow formula would result in a complicated formula and its application to design and operating problems would be greatly hindered.

More precise analyses of flows through individual lines may be made by means of the relation between the coefficient of friction and the Reynolds criterion. This relation is affected by factors particular to individual lines and for this reason no average relation can be recommended to apply over a wide range of pipe lines and flow conditions. The value of applying many small corrections to pipe line flows, such as small differences in elevation between the inlet and outlet of the line, reduced diameter fittings, the effect of bends, right angle turns, metering stations, drips, type of joints, and the length of pipe between joints is often greatly diminished because of conditions particular to individual lines such as unsteady rates of flow, storage or drainage taking place, the presence of condensates, rush and foreign material in the line, and the relative roughness of the interior walls of different lines. The possible effect of some of these conditions is often many times greater than the sum of all minor corrections that could be applied.

Late Fields

(Continued from Page 28)

The well also flowed 235 bbls. from the Hunton lime.

Empire Oil & Refining Co.'s No. 3 Brown, NW cor. NE SE, Section 3-8-5, flowed 110 bbls. of oil from the Hunton lime. It was being drilled deeper at 4,025 feet.

Prairie Oil & Gas Co.'s No. 2 Hessman. SW cor. SE NE, Section 3-8-5, flowed 50 bbls. of oil in 90 minutes from the Hunton lime at 3,954-73 feet.

Blackwell Oil & Gas Co.'s No. 1 Holmes, SW cor. NE SW, Section 9-7-8, west of Holdenville, flowed 85 bbls. of oil from the Booch sand at 2,923-70 feet in 12 hours with 25,000,000 feet of gas a day. It was shut in to tear down the rotary tools.

KANSAS

Lario Oil & Gas Co.'s No. 1 Suffied, SE cor., Section 25-19-2w, in Ritz-Canton Pool, McPherson County, was completed with a potential of 2,710 bbls. of oil a day from the Viola lime at a total depth of 3,415 feet. Same company's No. 1 Lagree, NW cor., Section 31-19-1w, made 1,150 bbls. of oil in 12 hours and has been credited with a potential of 2,300 bbls. a day. No. 2 Lagree, SE cor. NW, Section 31-19-1w, made 1,580 bbls. of oil in 12 hours on the swab and was credited with a potential of 3,160 bbls. of oil a day.

The Texas Interstate Oil Co. and McNabb's No. 1 Johnson, C NW, Section 6-34-37w, Stevens County, in the Hugoton gas field, was completed for 6,000,000 feet of gas at a total depth of 2,750 feet. The Western Producing Co.'s No. 1 Greenwood, C NE, Section 11-34-36w, Stevens County, made 6,000,000 feet of gas a day at a total depth of 2,820 feet.

The wildcat test of Gypsy Oil Co.'s No. 1 Coleman, C SW NE, Section 25-17-25w, Ness County, found a showing of water in the Silicious lime at 4,709-15 feet and is shut down. It will probably be abandoned at the present depth.

Phillips Petroleum Co.'s No. 2 Miller, NW cor., Section 3-21-3w, in the Welch Pool, of Rice County, was drilled deeper to 3,494-96 feet where it made 15 bbls. of water. The well made an initial production of 600 bbls. a day when completed several years ago.

E. B. Shawver's No. 1 Decker, NE cor., Section 2-20-2w, is a new location in the Ritz-Canton Field in McPherson County, and is the south offset to the G. Dickey's No. 1 Decker, in SE cor., Section 35-19-2w, which was recently completed for 6,722 bbls. a day.

Lloyd & Turner and others' No. 1 Haury, in Section 1-23-4w, in eastern Reno County, will be given a 20-quart shot in the chat at 3,354-64 feet. The well made an initial production of 336 bbls. a day and is now making around 170 bbls. a day.

McPherson Oil & Gas Co.'s No. 1 Salthouse, in Section 15-19-2w, in the Decker gas field, of McPherson County, was drilling out cement plugs after rigging up standard tools, in the top of the chat at 2,912 feet, with a showing of gas.

Madison and others' No. 1 Hale, SE cor. NE, Section 24-19-2w, which extended production to the northwest in the Ritz-Canton Pool, was drilling out the cement plugs and preparing to complete.

EAST TEXAS

FORT WORTH, Tex., June 2.—Prairie Oil & Gas Co.'s No. 1 John Elda, William McCurry Survey, Gregg County, flowed 114 bbls. of oil first hour and 118 bbls. second hour through three-quarter-inch choke through tubing with 340 pounds back pressure. It is estimated good for 17,000 bbls. of oil. It is the Prairie Oil & Gas Co.'s first completion in the East Texas Field.

Sloan-Tokio Oil Co.'s (previously known as Sloan Prospecting Co.'s) No. 1 Windham in H. English Survey, Shelby County, Texas, made two heads of pipe line oil in four hours apart Wednesday, the first head for 7 minutes and the second for 12 minutes coming from broken chalk formation at 3,399 feet. Well is 7 miles southeast of Center. Two and one-half-inch tubing is being set.

Refugio Oil & Gas Co.'s No. 1 Hughey in the P. W. Warraner, slightly over a mile north of production in Gregg County, extends the Kilgore area near to the Lathrop area, proving another link between the pools. It came in making 150 bbls. the first hour through tubing and casing and on three-quarters-inch choke. Sand was cored from 3,465 to 3,503 feet. It is but a short distance south of the Sabine River and north of Heep Oil Co.'s producer, which was completed a few weeks ago.

DOWNWARD TREND IS CHECKED IN THE EAST

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tolerance, the percentages of gasoline and other products which can be refined from the crude, with the sellers in most instances being willing only to sell on a guaranteed gravity basis.

Foreign demand for American gasoline and kerosene continued of limited volume during the week, no cargo transactions being reported. Gasoline quotations, however, are getting down to a point where it is expected that foreign buyers, who have diverted their business to Rumania and Russia in many cases, will re-enter the American market.

Petroleum Exports

Some falling-off in export movement of principal refined products was reported locally during the week ended May 23, lubs in particular showing a reduction in movement.

The following table shows principal exports of refined petroleum products from New York for the past three weeks (all figures in gallons unless otherwise noted):

	Week ended		
	May 23	May 16	May 9
Gasoline	190,000	195,000	60,000
Naphtha	235,000	375,000	65,000
Kerosene	12,000	33,000	10,000
Fuel oil	25,000	18,000	5,000
Lubricating oil	1,225,000	3,175,000	1,175,000
Petroleum, ref.	490,000	895,000	875,000
	Pounds		
Petrolatum	55,000	7,000	.....
Paraffin wax	1,380,000	1,680,000	1,565,000
Refined	185,000	45,000	75,000
Scale	975,000	1,050,000	725,000
Lubricating grease	600,000	1,050,000	610,000

Cased kerosene and gasoline is moving in but limited volume locally, much of the current movement consisting of shipments by leading integrated companies to their foreign marketing subsidiaries. Russian competition has cut heavily into open market export sales of cased products by American refiners.

California Oil Receipts

Receipts of California crude and refined petroleum at Atlantic and Gulf Coast ports for the week ended May 23 totaled 401,000 bbls., a daily average of 57,286 bbls., compared with 544,000 bbls., a daily average of 77,714 bbls. for the previous week and a daily average of 55,393 bbls. for the four weeks ended May 23. Details follow:

	Bbls. of 42 gals.
At Atlantic Coast ports—	
New York	287,000
Philadelphia	114,000
Total	401,000
Daily average	57,286
At Gulf Coast ports—	
All ports	None
At Atlantic and Gulf Coast ports—	
Total	401,000
Daily average	57,286
Daily average four weeks	55,393

Distribution of total California oil receipts is as follows:

At Atlantic Coast ports—	
Gasoline	306,000
Fuel oil	95,000

Shipments of California refined products for Atlantic and Gulf Coast ports during the week (with identity of owner of tanker moving the oil where such owner is an oil company) follow:

To Philadelphia—56,300 bbls. of gasoline on the J. W. Van Dyke (Atlantic Refining Co.).

Charter Market

There was some improvement in the demand for tanker tonnage in the charter market last week, but rates continued near record low levels, and shippers were finding it comparatively easy to secure vessels on pretty close to their own terms.

A contract closed for California fuel oil during the week for shipment to Europe over the next few months, and requiring three or four trips, was expected to remove some of the distressed tonnage from the Pacific Coast market.

Fixtures during the week were as follows:

Steamer Oilshipper (Br)., 8,000 tons, clean, Black Sea to French Atlantic ports 7/-, option 6,000 tons cargo 8/-, June.

Steamer Ramona (It.), 5,000 tons gas oil, Black Sea to Rouen 6/-, option Constanza loading 8/6, June.

Steamer Oiltrader (Br.), 8,000 tons, clean, Black Sea to French Atlantic ports, 7s; option 6,000 tons cargo 8s, June loading.

Motorship Anna Maersk (Dan.), 3,406 net, gas and/or fuel oil, Constanza to Ceuta 5s 9d, end June loading.

Motorship Bianca (Nor.), 3,445 net, gas and/or Diesel oil, Black Sea to Leningrad, 9s; one, two or three voyages, end May/early June.

Motorship Jenny (Nor.), 3,000 tons part cargo, gas oil, Constanza to Ghent 8s 6d, balance of cargo Constanza to U. K. (no rate), June loading.

OPPOSING DEVELOPMENTS ARE FOUND IN CHICAGO

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Prices on fuel oils and gas oils which have been announced for the season of September, 1931, to May, 1932, to the ultimate consumers by a major company are as follows (per gallon): 18-22, 4 cents; 24-26, 4¼ cents; 28-30, 5 cents; 32-36 (190 to 200 flashpoint), 5 cents; 34-36 (170 to 190 flashpoint), 5 cents; and 38-40 (straw distillate), 6½ cents. The three fuels posted at 5 cents are subject to a refund of one-half cent for quantities of over 15,000 gallons. To bring out the significance of these prices a table may be presented showing the sales price per gallon, the margin for the jobber (this includes all costs), and the most the jobber can afford to pay for the products:

Grade—	Maximum cost (cents)	Gross profit (margin) (cents)	Sales price (cents)
18-22	*50	¾	4
24-26	*57	¾	4¼
28-30	*69	1	5
32-36	01 3/5	1⅖	5
34-36	01 3/5	1¾	5
38-40	02¾	1¾	6½

*Per barrel.

In Chicago, Standard Oil Co. of Indiana offers tank wagon prices on furnace oils of 8½ cents, with a 2-cent discount for quantities of 100 gallons or over, and a price of 7 cents, with 2-cent discount for quantities over 200 gallons, on a low cold test fuel oil of 18-22 gravity.

An order of U.G.I. gas oil amounting to 50 cars went to an industrial consumer last week at a price of 1 cent a gallon. This was low cold test material (zero to 10 degrees) suited for a special purpose and so commanded a price above the ruling market, which has sagged to seven-eighths of a cent.

METHOD SUGGESTED FOR POTENTIAL PRODUCTION

(Continued from Page 20)

the physical properties of the oil, and the quantity of free gas which is associated with the oil are the important factors which control the pressure drop in the sand for a given rate of flow. Porosity and sand thickness, by controlling the area of the pore spaces through which oil may flow, fix the linear velocity which must be established to maintain a given rate of production. Permeability depends upon the effective, or average, diameter of these pore spaces and, hence, controls the pressure gradient which is required to maintain a certain velocity of flow. The physical properties of the oil (especially viscosity) influence pressure losses in a similar manner. Large quantities of free gas flowing to wells must, of course, occupy a considerable portion of the space between the sand grains, thus reducing the void space through which oil may flow. This effect probably influences the pressure losses.

Recoverable Oil

The amount of oil underlying a given property is directly proportional to sand thickness, porosity and saturation. The amount of this oil which can be recovered depends upon permeability, the conditions existing in the reservoir (such as pressure and temperature), and the nature of the oil. As was shown previously, these same factors affect in a comparable manner the rate at which oil can be produced with a given pressure drop. Thus, the production rate at a given pressure drop should be a good index of the recoverable oil under a property.

If open flow test resulted in the same bottom-hole pressures in all wells in a field, the open flow production could be used as an index of the productivity of a property. Unfortunately, the bottom-hole pressure at open flow is markedly influenced by the back pressure at the well head and the pressure drop in the flow string. The back pressure at the well head even under open flow is not zero, but depends upon the size and length of the lease lines and the location of the separator. The pressure drop in the flow string depends upon the depth of the well, the size of the tubing or casing through which the oil is conducted to the surface, the gas-oil ratio, and the production rate. By changing the design of the flow string and the surface equipment, the bottom-hole pressure at open flow and, consequently, the potential production, can be varied over a wide range. Furthermore, if the test covers only a short period, the open flow gauge is affected by the history of the well immediately before the test. For these reasons, open flow tests are not comparable and do not furnish a true measure of the capacity of the various wells to produce oil.

Measure of Production

It is obvious that a true measure of the rate at which wells are capable of producing oil must depend on the character of the producing formation and the conditions under which the fluids therein are found. The equipment which happens to be in the well should have no bearing whatsoever upon its allowable production under the restrictions imposed by proration. It is seen, therefore, that a need exists for some method of measuring the ability of a well to produce which is dependent only upon the nature of the sand and the conditions existing therein, data for which can be obtained without resorting to excessive rates of flow. If the new method is to be used in a field already under proration, practical considerations require that allowances distributed according to the new method should not differ widely from those distributed under the existing method.

Proposed Method

In order to meet the need for such a method, the following system of allocating production allowances in prorated fields is proposed:

The field is divided into units of equal areas. Twenty-five per cent of the total production is distributed equally among the various units. The remaining 75 per cent is distributed among the units in proportion to their capacity to produce oil. These capacity allowances for the individual units are determined from the curves showing the relation between bottom-hole pressure and production rate. Inasmuch as the pressure differential in the sand is the driving force which causes the flow of oil to the well, an equitable method of distribution would allow all operators to produce oil under a driving force which is a certain percentage of total driving force available. Hence, for any given well, the allowance is the rate at which it can produce oil when the pressure drop in the formation is a definite percentage of the rock pressure. This percentage is fixed for the entire field. On units having more than one well, the capacity allowance for the unit is the average of the capacity allowance of the various wells thereon. For units having more than one well, the allowance may be taken from a single well or distributed among the various wells in the unit, depending upon local conditions; but in no case shall the sum of the production from the various wells exceed the unit allowance. The percentage of the rock pressure used in determining the capacity allowances is so adjusted that the sum of the unit capacity allowances will be 75 per cent of the total production which it is desired to take from the field. The determination of the value of the percentage of rock pressure which will fix the field production at any required value may be accomplished by simple interpolation. A procedure which may be followed in this determination is outlined in the numerical illustration given below.

Numerical Illustration

In order to illustrate more clearly the application of this proposed system, the following example of its application to an hypothetical field is given. The data required to determine the relationship between bottom-hole pressure and production rate, as well as the open flow tests, for the wells in this hypothetical field have actually been taken on seven wells in West Texas. The curves showing these relationships are presented in Figure 2. Let us assume that these seven wells constitute an entire field whose total production is to be 1,000 bbls. per day. Assume wells "D" and "E" to be in the same unit. In estimating the allowances, the first problem is to determine what the percentage drop of rock pressure for the field shall be in order to restrict the production of the field to the required value of 1,000 bbls. per day. From the curves in Figure 2, the production of the wells corresponding to any desired pressure drop in the sand may be read. By assuming a value for the allowable percentage drop in rock pressure, the corresponding production of each well in the field may be determined. The average capacity allowance of the units is then calculated. The sum of the capacity allowance of all units is added to obtain the total capacity allowance of the field at this percentage drop in rock pressure. The acreage allowance is then added to obtain the total field production. The production of the field is then estimated for other values of allowable percentage drop in rock pressure, thus establishing a curve of allowable pressure drop against total production of the field. Such a curve for the hypothetical field in question is shown in Figure 3. From this curve, the allowable pressure loss which will fix the production at any required value is easily read.

For an outlet of 1,000 bbls. per day, the allowable percentage drop in rock pressure for the hypothetical field is seen to be 1.37 per cent. Table 1 presents a summary of the calculation of the allowances of the various units by this method.

For the purpose of comparison, let us now estimate the allowances of the units on the basis of the potential production determined by the open flow test. Table 2 gives the actual open flow tests, the average unit potential, and the fraction of the total unit potential which each unit contributes:

TABLE 2—OPEN FLOW TESTS

Well	Open flow test (bbls. per hour)	Average Unit potential (bbls. per hour)	Fraction of total
A	66	66	0.0705
B	379	379	0.4060
C	64	64	0.0680
D	255	158	0.1680
E	62	...	.....
F	98	98	0.1045
G	171	171	0.1830
		936	1.0000

If the outlet of the field is to be 1,000 bbls. per day, 750 bbls. are to be dis-

TABLE 1—ALLOWANCES DISTRIBUTED IN ACCORDANCE WITH PRESSURE DROP METHOD

Well	Lbs. per sq. in. Rock pressure	Lbs. per sq. in. Allowable pressure drop*	Barrels per day Allowance on capacity†	Barrels per day Aver. unit allowance	Barrels per day Unit allowance on acreage	Barrels per day Total allowance
A	437.0	5.99	34	34	41.7	75.7
B	671.0	9.20	361	361	41.7	402.7
C	700.0	9.58	51	51	41.7	92.7
‡D	633.0	8.66	153	99	41.7	140.7
‡E	659.0	9.03	44			
F	600.0	8.21	26	26	41.7	67.7
G	634.5	8.70	179	179	41.7	220.7
				750	250.2	1,000.2

*Allowable pressure drop is equal to 1.37 per cent of rock pressure. †Read from curves on individual wells shown in Figure 2. ‡Wells "D" and "E" on single unit.

tributed in proportion to the average unit potential. The allowance of each unit which is based on potential is the ratio of the average unit potential to the total potential, multiplied by the field allowance which is to be distributed in proportion to the potential. Table 3 is a summary of the calculations involved in the distribution of these allowances upon the basis of the open flow test.

TABLE 3—ALLOWANCES DISTRIBUTED IN ACCORDANCE WITH METHOD USING OPEN FLOW TEST

Unit	Ratio average unit potential to total potential	Barrels per day: Unit allowance on potential	Barrels per day: Unit allowance on acreage	Barrels per day: Total allowance
A	0.0705	53	41.7	94.7
B	0.4060	304	41.7	345.7
C	0.0680	52	41.7	93.7
D-E	0.1680	126	41.7	167.7
F	0.1045	78	41.7	119.7
G	0.1830	137	41.7	178.7
		750	250.2	1,000.2

In Table 4 is presented a comparison of the allowances of the various wells as calculated on the basis of the open flow tests and on the basis of pressure losses in the sand for field outlets of 1,000 bbls. per day and 2,000 bbls. per day.

TABLE 4—COMPARISON OF METHODS

Unit	Outlet 1,000 bbls. per day: Open flow	Outlet 1,000 bbls. per day: Pressure drop	Outlet 2,000 bbls. per day: Open flow	Outlet 2,000 bbls. per day: Pressure drop
A	94.7	75.7	189.3	149.5
B	345.7	402.7	692.3	820.3
C	93.7	92.7	185.3	182.3
D-E	167.7	140.7	335.3	281.3
F	119.7	67.7	240.3	139.3
G	178.7	320.7	357.3	427.3

It is seen that there is a fair agreement between the allowances calculated by the two methods. However, the open flow tests on these wells were taken some 18 months prior to the bottom-hole pressure data. Because of this, and because the open flow tests are not comparable among themselves due to differences in the equipment in the wells and the manner of taking the tests, a close agreement is not to be expected.

Securing Necessary Data

The successful application of this method depends, to a large extent, upon the development of a simple, rapid and accurate means by which bottom-hole pressures can be determined. Recently, several successful types of instruments have been developed which may be run in the wells on wire lines. These instruments are, in general, of two types: Those recording pressures continuously, in which a chart is moved by means of clockwork; and those in which maximum pressures only are registered. The former type have the great advantage of furnishing a record of bottom-hole pressures throughout the entire period of the test. However, because of the limitations imposed by the size of the clockwork, these instruments are usually too large to be run in wells equipped with small tubing. Successful maximum registering instruments have been built with outside diameters as small as 1⅛ inches. These instruments, however, must be run each time the conditions in the well have changed, if the effect of pressure upon these conditions is to be studied. The development of such instruments is being carried forward, and within the near future devices which incorporate the advantages of both types may be available.

Under favorable conditions, two men can make about four determinations of bottom-hole pressure in a working day. If men are available to install and remove the lubricators through which these instruments are run, thus relieving the man who runs the instrument from this work, it is believed that as many as eight determinations may be made in one day without difficulty. By studying a group of four to eight wells simultaneously, and allowing 24 hours for the conditions to become steady after changing the rate of flow, six points on the curves of bottom-hole pressure versus production rate for each well in the group may be established in a week. Usually this number of points is sufficient to determine the curve. The labor involved in the collection of the required data is one of the most serious disadvantages of this method.

The following advantages of this proposed system may be reviewed:

1. The pressure drop in the sand furnishes a measure of the capacity of the well which is superior to the open flow test. However, allowances under this system are not radically different from those given under the open flow test.

2. Under this proposed system, the size and type of flow strings and surface equipment which the operator may choose to install will have no bearing upon the allowable production of the wells. Hence, efficient and economical equipment may be employed without penalty.

3. By establishing substantially uniform pressure drops in the sand, the tendency to withdraw oil which underlies one property through wells on neighboring properties will be reduced.

4. The control of the pressure drops exercised throughout the field will reduce the tendency toward the formation of low-pressure areas and gas channels. There is little doubt that in many instances low-pressure areas are conducive to serious water encroachment.

5. The data required for this system can be taken at rates of flow which need not be much greater than the normal production rate for the well. Inasmuch as serious water encroachment is frequently caused by the open flow test, this is an important advantage.

Disadvantages of Proposed System

However, in this proposed system there are certain inherent disadvantages:

1. The most important factor which limits the practical application of this proposed method is the labor and time involved in securing the necessary data. It is believed that, with proper organization and adequate equipment, this difficulty can be overcome.

2. A minor disadvantage is the experimental error involved in measuring the bottom-hole pressure. This will be serious only in the case of very large wells, and in any instance these data on bottom-hole pressures can be taken more accurately than can an open flow gauge.

In proposing that allowable productions under proration can be determined by the methods outlined herein, the authors realize that due to a lack of knowledge of the laws governing the flow of oil and gas in natural reservoirs the ultimate solution to the many problems of proration has not yet been developed. This system is simply suggested as a workable method which is superior to those now employed, and is recommended for use until it in turn is superseded by a better one.

UNIT PLAN OPERATION AT KETTLEMAN HILLS

(Continued from Page 22)

1931. The facilities were bought and paid for by the association under one major call issued to the members.

One of the fundamental principles underlying the entire organization is that the crude oil, wet gas and gasoline belongs to the individual members. The association acts merely as their agent to produce them, safeguard them and finally deliver them to or on the member's order. Dry gas, because of the difficulty of deliveries in kind, was considered as being owned by the association and, as such, is the only product in which the association has a financial interest.

The reasons for the members' insistence upon owning their share of the products lies in the desire for individual action. Some expected delivery in kind, others wanted the right to seek competitive markets. On the other hand the agreement provides that if a member is unable to find a market for his products, the association must dispose of them if he so requests.

Distribution of Products

In order to distribute the products equitably to the members, a standardized basis for computation had to be adopted. Government subdivisions of 640 acres and equal fractions thereof were selected. In some cases sections contain odd amounts, such as 656.36 acres. So far as the association is concerned, such a section is a standard 640-acre unit, and all acres have equal participation. Property lines have been eliminated and the products are allocated equally to each acre in the field, regardless of where that product was actually produced. In other words, the oil, wet gas and gasoline is pooled. Dry gas contracts have likewise been pooled for the proportionate benefit of all members, except the Milham Exploration Co., which was given the right to receive the benefits of its own favorable contract, by reason of the fact that it was the discoverer of the field.

Payment of royalties is an individual member's responsibility. On the other hand, all taxes, except income taxes, are paid by the association, pooled, then proratably charged against each member.

Many of the members felt that Kettleman Hills had never been granted its rightful place in the crude oil production program of the State, and insisted upon providing in the agreement that the association produce during 931 its acreage percentage share of 50,000 bbls. per day. Association production on April 1, 1931, was approximately 3,000 bbls. daily. At the present time there are eight wells drilling in order to comply with the terms of this provision.

All government leases in Kettleman Hills carried the standard provision of 5 per cent royalty on the "A" leases and the sliding scale royalties on the "B" leases, ranging from 12½ per cent to 33⅓ per cent of the oil produced, dependent upon the size of the wells. The Secretary of the Interior, in order to carry out the fundamental principles of unit operation, was permitted to change the royalties on the "B" leases under authority of a special act of Congress, so that the sliding scale royalty on such leases was made applicable to the total association production rather than to the production of the individual well. When the production from the association acreage is under 13,799 bbs. daily the royalty is 12½ per cent; when it is between 13,799 and 27,598 bbls. daily, 16⅔ per cent; between 27,598 and 55,196 bbls. daily, 20 per cent; between 55,196 and 101,192 bbls. daily, 25 per cent; and over 101,192 bbls. daily, 33⅓ per cent.

Gas Royalties

The original act of Congress, authorizing the Government's entry into this unit operation plan, expired as of January 31, 1931. In December, 1930, as this expiration date drew closer and closer, committee meetings were held almost daily. The fundamental principle of pooling of interests had been accepted and adopted, but there still remained the task of obtaining actual signatures, not only of members, but of the excessively large number of royalty owners. The government royalty on oil had been adjusted, but the necessity for a similar adjustment in the regulations covering the handling of gas royalties was not apparent. It was only after the association was actually formed and had taken over the operation of the properties that the inequity of the existing regulation was disclosed. In view of the fact that 15 of the 17 wells completed on government acreage were located on "A" leases, if the formation of the association had failed, the royalty payable to the Government for many years to come would have been largely on the basis of the 5 per cent specified for "A" leases, whereas actual royalty due on the basis of April sales was in excess of 11 per cent. Likewise, the present regulations specify payment of royalties on the "B" leases on a quantity basis, regardless of their size, in effect penalizing the lessee for keeping his property intact rather than dividing it up into numerous small leases. Obviously, no such inequity was contemplated in the regulations when originally issued. A letter, setting forth in detail these inequities has recently been forwarded to the Secretary of the Interior, who doubtless will show the same spirit of co-operation displayed in the adjustment of the oil royalties.

At the time the association took over the properties on the effective date, April 1, 1931, two of the 17 wells completed to the top of the Temblor, or tested for production, were producing approximately 3,000 bbls. of 60 gravity oil daily. Both of these wells had extremely high gas-oil ratios ranging between 40,000 and 45,000 cubic feet per barrel. Just as soon as production is obtained from the so-called "black" oil zone, these wells will be "killed." In the "black" oil zone, gravity ranges from 32 to 38 degrees and ratios from 900 to 3,500 feet per barrel.

The average gasoline content of the wet gas from the upper zone is slightly under 1½ gallons per 1,000 feet on the high pressure lines and from 7 to 9 gallons on the low pressure. Naturally, when the upper zone wells are shut in the "black" oil production will furnish gas of higher gasoline content.

As the property operated by the association is probably the largest single property under one management, at the outset systematized methods were considered absolutely essential. Likewise, no precedent existed for the operation of a non-profit oil producing association.

Accounting System

Probably the foremost in importance was the accounting system. In distributing on the books the members' share of crude oil production, the accounting proved somewhat complicated, because of part deliveries in kind and part direct sale by the members. This was still further complicated by the provision that the members could elect to have the association dispose of their oil for them. At first an attempt was made to set up the books on a value basis, but without success. At the time the association went into effect, there were five pipe lines serving, or within reasonable connecting distance of the field. Only one of these had an established price. The association, therefore, requested all others to post field prices. Because of a federal injunction prohibiting the pipe line companies from conferring in the establishment of crude oil prices, they rightfully refused. Later, the same pipe line companies were requested to mail to the association an individual price schedule. This was considered a technical violation of the injunction and was refused. The suggestion was then made that a distillation test be conducted of the different oils, so as to break them down into gasoline, kerosene, gas oil and fuel oil, with the request that each company establish prices on the individual products. Again, this was considered a technical or illegal violation of the injunction.

With the door closed to keeping accounts on a dollar basis, the gravity basis immediately suggested itself. It was soon realized that gravity was nothing but a name. Should the association fill a tank with 60-degree gravity oil, it would be required to credit each member with his pro rata share. Standing overnight, it might drop in gravity to 59.9 degrees. Occasion might arise where the association never produced another barrel of 60-degree gravity oil and would therefore be unable to make actual delivery of the product credited to the member. Likewise, later on, the mixing of small amounts of high gravity with, let us say, 32-degree gravity might be advisable in order to obtain the best price for the members. If the association had already credited the members with the 32-degree gravity, delivery of the composite crude to one particular member could well result in inequities to the other members. Obviously, the matter offered so many complications that the present system, the simple A.S.T.M. "Engler" distillation test was adopted.

Distillation Test

Under this system, each time the volume of oil in a tank changes either by means of shipment from it or production run into it, a sample of crude is taken. A 300 cc. sample is placed in a flask, the temperature raised to 425° and the percentage distilled over at that temperature computed. The resulting quantity is known as the "first cut." The remainder of the sample is then run up to 550°, where the "second cut" is made and the "third cut" is determined merely by subtracting the total of the first and second cuts from the total placed in the flask. This datum is reported to the Los Angeles office daily and the total day's production of net barrels broken down into first, second and third cuts, is then distributed proratably to the accounts of members according to a table of fixed percentages.

The accounting record for the oil starts at the shipping tanks rather than in the flow tanks, by keeping a daily inventory or running record. The necessity for computing gains or losses between these two points is eliminated, such gains or losses being automatically distributed proratably to all members.

The handling of the wet gas production offered similar problems. It was immediately apparent that some uniform yardstick for the equitable distribution of this product had to be found. Although many different methods suggested themselves, the most equitable one seemed to be distribution on the basis of "theoretical gallons." Naturally, if a standard uniform yardstick be used and distribution be made on as nearly average quality as possible, as required by the agreement, the association could distribute to the plants with whom members were contracted not only that member's fair share of the allocated volume, but his fair share of the total "theoretical gallons." Due to the fact that production and delivery of wet gas are practically simultaneous, no inventory or running record of the members' balances would be required and record of allocations of wet gas production could be kept by plants rather than by individual members.

Obviously, it would be unfair to deliver to one plant all high-pressure gas of 1½ gallons per 1,000 feet and to another all low-pressure gas or 7 to 9 gallons per 1,000 feet. Therefore, the association adopted the California Gasoline Association's Bulletin No. 282 as the common yardstick to be used for determining the "theoretical gallons" and will undertake in the future, to distribute to each plant equitable percentages of both high-pressure and low-pressure wet gas. All tests will be conducted by the association gas engineer on its own apparatus and every test will be made in the presence of representatives of all gasoline plants in the field if they desire to be present. Naturally, each plant is interested in the quality of gas being delivered to other plants in the field, as all allocations are based on the total volume and "theoretical gallons" produced.

Disposal of Wet Gas

Under the agreement, each member must make election as to the disposition of his share of the wet gas to be produced by the association. Owning this product outright, he must contract with an existing plant or erect one of his own. Assuming that four members of the association contract with an individual plant and that their total percentage amounts to 40 per cent of the entire association, that particular plant is entitled to 40 per cent of the production. The obligation of the association, then, is to deliver to that plant, in so far as it is within its power, not only 40 per cent of the total volume, but 40 per cent of the total "theoretical gallons" as well. Monthly balances of excess or short deliveries of both volume and "theoretical gallons" are being kept by plants, so that serious inequities may eventually be corrected.

The association, because of its peculiar position of an operating agent only, is not interested in the actual number of gallons made out of the "theoretical gallons" delivered. The gasoline plant's responsibility is to the member with whom he is contracted. Should a member contract with a plant of poor efficiency, or at a lower price than offered by another plant, the responsibility falls squarely on the member and not on the association. The association, however, has indirect control over the operations of the plant in that it acts to some extent as the agent of the individual member.

Because of the widely divergent field practices used by the operating companies and gasoline plants, it was apparent that adoption of certain standards was essential. These covered such items as a uniform time for changing all charts in the field and the use of 14.73 as a standard pressure base for computing volumes. Formerly this base ranged from 14.4 to 14.93 pounds. Similarly, such other items as shrinkage factors, methods of determination of specific gravities, deviation factors, and correctness for temperatures and altitudes, all had to be considered. A bulletin covering these subjects is in the process of preparation.

The handling of the dry gas required special consideration. Although the wet gas delivered to the plants belonged to the members, the residue gas leaving the plant is owned by the association, which in turn delivers it to the gas purchasing companies or uses it as fuel. The dry gas contracts of the members have been pooled, with the exception of the Milham Exploration Co. Therefore, all money received under such contracts is pooled for distribution proratably to all of the members, except the Milham Exploration Co.

A contract between the Standard Oil Co. and the association, in the process of preparation, covers certain salient factors of importance to both units. In this the Standard Oil Co. agrees to maintain its property as a unit as long as the association does likewise. They agree to bear their acreage percentage of the exploratory drilling program. They expect to take out of the structure only their fair acreage percentage of the entire field's production. Drainage as between the lands operated by the association and the Standard Oil Co. are to be equalized, not necessarily by direct offset drilling but through compensating wells located, perhaps, many locations apart. In the case of disputes, the proposed contract provides for arbitration.

Simplified Records

Operation of a property the size of Kettleman requires the establishment of simplified systems for keeping of records. The seven original government permits have been divided up until 28 leases are of record, all carrying the name of the original permittees, but in addition the new owners' names. Admittedly, confusion in well numbering would have resulted. It was, therefore, decided to adopt the method employed by the Standard Oil Co. in the numbering of its wells. Under this system any well located on Section 2, Township 22, Range 17, carries, in addition to the well number itself, the designation 2-P, the symbol "P" representing that particular township and range. Similarly, by adopting their standardized section plat, each well of a given number has the same position on all sections in the field. After considerable correspondence with the United States Government and the State Mining Bureau, this system was found to be acceptable to them and all reports now contain only the symbols instead of the long descriptive names formerly used.

Likewise, a tank numbering system became essential. All tanks are now numbered by showing, first, the designation of the location; second, the size of the tank, and, third, the chronological order time of its erection. For example, 2 P-2518 represents a tank erected on Section 2 P. The first two numbers refer to the 2,500-bbl. capacity, the remaining two numbers constituting the actual number of the tank in the order of the date of its erection. A similar meter numbering system is in the process of preparation. The numbers will show first the section, township and range, second the actual number of the meter in the order of the date of its erection on that section, and third a symbol designating its use. For example, meter number 2P-12-W would indicate that this meter is a "well" meter whose actual number is 2, located on Section 2-P, the "W" symbolizing the word "well." Other symbols such as "P" for plants, "U" for utilities, "B" for booster, etc., will be used.

In general, the obligations of the association are unique. It is a nonprofit organization, nonmarketing, norefining, nontransporting. Its entire function is that of a producer without profit to itself. Its records are open to its members' representatives, its members' royalty owners and to the Government at all times.

William Reinhardt, the general manager, has very properly taken the position that the best interests of all concerned in Kettleman Hills will be served by co-operation. With this in mind, the association has taken the initiative in sending out at the end of its first month's operations a copy of its monthly production report, not only to the State Mining Bureau, United States Government, and all members, but to each operator in the field. Logs of wells are being freely exchanged and correct drilling information is available to all concerned. Matters involving members' contracts only, over which the association has no control, must be kept as confidential by the association.

Minimum of Overhead

Contrary to natural expectation, the organization is being conducted with the minimum of overhead. Many of the companies were fearful that considerable duplication of their own overhead would result. It should be pointed out that, aside from the general manager and a combination secretary-treasurer, the Los Angeles office consists of a purchasing agent, chief accountant and nine other employes, which includes a P.B.X. operator and an office boy.

Recently a rather general impression has existed among the California operators that unit operation was a scheme designed primarily to throttle production. It should be borne in mind the Kettleman North Dome Association had its inception as a United States Government conservation measure for the protection of natural resources. The Secretary of the Interior undertook, because of the Government's large interest, the task of unitizing this most important oil field to protect it from drainage and waste. It was but a short time ago that more than 300,000,000 cubic feet of gas per day was being blown to air, forever unrecoverable and at the expense of lost future production. Wastage of such nature, impossible to prevent at first due to the physical condition of the association's two wells, constituted one of the most serious problems of waste confronting the industry. Fortunately, in the very near future this wastage will be eliminated.

Shortly after the Government undertook to unitize this area, the threat of overproduction in California became of paramount importance. As time went on, it became more and more apparent that the industry had come to look upon the unit operation plan proposed for Kettleman Hills as the simplest and most efficient method of curtailing production, thereby losing sight of the fundamental principles underlying the entire plan. This method of operation, notwithstanding statements to the contrary, still stands as the one fundamentally sound method for obtaining for each owner of land on the structure his fair share of the products underlying his property, without fear of "legalized theft."

The Kettleman North Dome Association is the first of its kind in California. It is young and perhaps some mistakes will be made. Doubtless there are some mistakes, even inequities, in the agreement under which it was formed, yet the fact remains that for more than a year and a half executives, engineers and lawyers bent every effort to work out a fair and equitable solution of this problem. Time only will prove that this work has been worthy of the conscientious effort involved in its consummation.

Grateful acknowledgement is given to William Reinhardt and to C. E. Sampson, general manager and secretary-treasurer, respectively, of the Kettleman North Dome Association, for their assistance in the compilation of the information presented.

GREAT VALUE OF SOIL CORROSIVITY SURVEYS

(Continued from Page 28)

of an original line and the life of the replaced or reconditioned sections for a number of locations. Imperfect reconditioning may account for the few discrepancies between the two lines.

TABLE 2—LIFE OF PIPE RENEWALS

Life in Years			
Original	Renewal	Original	Renewal
19	9	13	16
23	8	19	17
17	19	13	16
15	16	19	10
17	19	13	16
13	16	19	14
17	19	13	16
13	16	14	11
17	19	16	4

Bases for Corrosion Surveys

The earliest attempts to determine whether soils were corrosive were based on the idea that the soil contained some corrosive element which would be identified by chemical tests. A better understanding of the phenomena involved has made it clear that conditions as well as materials must be considered. As some might state it, soil when removed to the laboratory in the ordinary way ceases to be soil, because it has been mixed and separated from its environment. Some scientists have attempted to apply the electrolytic theory of corrosion to corrosion surveys, and have studied potentials, soil resistivity, over-voltages and polarization. So far the theories of corrosion have been more helpful in explaining what has been observed than in foretelling what the future will show.

Identifying Corrosive Soils

1. Chemical tests. Chemical tests unsupported by other data have proven rather unsatisfactory as a means of identifying corrosive soils. While the presence of large amounts of acids, sulphates or chlorides indicate corrosiveness, corrosion has been found in the absence of these indicators of bad soils. Usually simple electrical tests will serve as well to identify corrosive soils as the more difficult chemical analyses.

An elaborate soil survey involving chemical analyses of soil was made in 1927 by Ford, Bacon & Davis, Inc., in co-operation with J. W. Richards & Son for the Amarillo-Denver gas line. Analyses were made of both soils and soil extracts. The information thus obtained was supplemented by studies of topography, rainfall, and the behavior of pipe lines in adjacent territory. Just how the data were treated has not been made public, but they were made the basis for recommendations as to the protection of the line.

In 1930 the line was examined in 66 places by S. P. Ewing, in co-operation with the owners of the line. Ewing's results have been analyzed by William Thompson Smith of Ford, Bacon & Davis, Inc., who reached the conclusion that if the degree of protection required is taken into account, the 1927 estimations of the corrosiveness of the soil were correct in 72 per cent of the cases investigated. This result is in very close agreement with that of Ewing who found that the percentage of correct estimations of soil corrosivity was 73.1. Most of the errors appeared to be caused by overestimating the corrosiveness of the soil. Smith also divided his soils into groups—those which required some protection, and those which did not; and found on this basis that the 1927 predictions were 92 per cent correct. He also showed that the predictions were more nearly correct than those based on the appearance of the right of way.

Chemical Methods

Among the chemical methods of determining soil corrosivity are those suggested by Holler. The first of these is based on the fact that when iron corrodes in acid soil, hydrogen is evolved. Holler mixed 10 grams of soil with 10 grams of iron filings and placed the mixture in a specimen tube. Over this was mounted a test tube filled with water. The mouth of the test tube was closed by inverting it in a wide-mouthed bottle filled with water. As hydrogen was evolved, it was trapped in the test tube. The amount of hydrogen evolved in a given time was taken as a measure of the corrosivity of the soil. The amount of hydrogen evolved is influenced by the fineness of the soil and the amount of surface of the particles of iron. The conditions of the test simulate those in very wet ground, and it is doubtful whether the results of the test would be applicable to soils which normally contain only a small percentage of water. The method apparently measures the acidity of the soil and is not applicable to alkali soils.

Holler, in extending his studies of the acidity of soils in relation to corrosion, showed that the corrosiveness of acid soils may be indicated by their total acidity. Estimations of total acidity were made by electrometric titrations of soil suspensions with standard alkali, and also by comparing the pH values of the soils in water and in potassium chloride solution. For a number of soils a close relation was shown to obtain between the amount of hydrogen evolved by the

method previously described and values for total acidity obtained by titration.

Denison, employing somewhat different methods, showed that for an oil line which he studied there was a fairly close relation between the total acidity of the soil and the amount of replaced pipe.

Grodsky has suggested a corrosion test in which very thin steel discs are placed in crystallizing dishes filled with soil. The dishes are placed in an electric oven in which a saturated atmosphere and a constant temperature are maintained. The loss of weight during a two-week period indicates the corrosivity of the soil. The results of this test were consistent with the losses on a line in Ohio along which soil samples were taken. Similar tests of soils from a line in Mexico also checked fairly well with the observed condition of the line, although the use of a protective coating on this line interfered with the comparison.

Electrical Tests

2. Electrical tests. Turning to electrical methods for determining soil corrosivity, we find a variety of tests. One of the earliest was developed by J. F. Putnam, who formed 10 feet of No. 28 iron wire into a coil 2 inches in diameter. The coil was held in shape by an insulating frame. One end of the wire was attached to a one-fourth inch iron rod in the center of the coil, and a potential difference of two volts was maintained between the rod and the other end of the wire. The rod and wire were imbedded in the soil to be tested. After 96 hours the wire was examined for the location of a point at which the type of corrosion changed. From the length of the wire and the impressed voltage the potential difference between the rod and the point of change in corrosion was computed. This potential difference is supposed to be that required to cause current to flow through the soil, since electrolytic corrosion occurs over that portion of the wire at the higher potentials with respect to the rod. It is the potential required to overcome the over-voltage at the anode plus the "IR" drop through the soil. Putnam designated this as the ionization potential, and found the corrosiveness of his soils to be inversely proportional to the ionization potential. Later Putnam developed another method of determining soil corrosivity. The soil to be tested is packed in a frame of unit volume. A potential of 1.4 volts is impressed across the soil through steel plates fitting the ends of the frame. After 10 minutes the current flowing through the soil is measured by a milliammeter. This current, which for certain California soils Putnam found experimentally to be proportional to the corrosiveness of the soil, he represents by the formula $I = \frac{E_c - E_d}{R}$, where E_c is the "causation" potential, E_d the decomposition potential, and R the resistivity of the soil. Putnam selected 1.4 volts as the "causation" potential after considerable experimentation, and pointed out that this not only resulted in an agreement between his test data and field experience, but that this value was the potential between two electrodes in an electrolyte from one of which oxygen was excluded while a plentiful supply was furnished to the other one. The oxygen-deficient electrode corresponds to the condition at the bottom of a pit beneath a tubercle or rust incrustation. Putnam's idea of a single cause of corrosion is in line with Evans' theory of oxygen concentration cells. On the other hand, Kuhn has shown that the potentials causing corrosion underground are frequently much less than one volt.

According to Putnam, E_d is a measure of the tendency of the cell to polarise. It can be shown experimentally that the polarization experienced in the use of the Putnam cell depends largely on the current density. This in turn depends on the resistivity of the soil and upon the length of the cell. Hence the value of "I" in Putnam's formula can be influenced very materially by shortening or lengthening the test cell. It appears, therefore, Putnam's formula does not entirely represent the performance of his apparatus, and that soil resistivity affects his results in more than one way. Nevertheless, there seems to be more theoretical ground for Putnam's method than for some others.

TABLE 3—ANALYSIS OF SHEPARD'S DATA ON THE RELATION BETWEEN LINE CURRENTS, SOIL RESISTIVITY AND CORROSION

Line	Location	Amperes × years square feet	Minimum resistivity Ohm-Cm.	Computed average penetration of corrosion in mils: Rate per year	Total	Observed condition	Pipe wall thickness mils
E	12,100-12,700	0.0046	300	0.19	2.3	VBG and P	322
E	16,900-17,100	0.008	700	0.3	4.0	BG and BP	322
ST	.....	....	....	...	...	LBP	322
SB	49,800-50,200	0.0079	200	0.79	3.9	LBP	280
SB	52,350-56,350	0.0012	550	0.12	0.6	LBP	322
SB	56,400-59,100	0.001	....	0.12	0.6	RQ	322
SK	60,600-61,300	0.001	1,176	0.1	0.55	No data	280
	64,900-67,500	0.0010	6,216	0.06	0.5	No data	280
	71,000-71,600	0.0012	540	0.08	0.6	No data	280
	74,800-75,000	0.007	441	0.44	3.5	BGP Q	280
	87,200-87,400	0.0058	616	0.36	2.9	BGP Q	280
GB	11,400	0	600	0	0	No data	280
	19,750-21,000	0.0104	600	0.35	5.2	L	280
	19,400-19,600	0	900-1,500	0	0	L	280
	23,600-24,900	0.0053	1,000	0.18	2.6	No data	280
P	1,000-3,100	0.0020	350	0.13	1.0	L	322
	3,900-6,200	0.0013	1,000	0.08	0.65	No data	322
HH	159,300-159,700	0.002	800	0.14	1.0	No data	375
	161,850-162,200	0.0012	800	0.09	0.6	No corrosion	375
	166,700-168,300	0.0010	700	0.08	0.5	No data	375
HH	172,400	0	1,200	0	0	No data	375
	215,300-215,500	0.0042	800	0.3	2.1	No data	375
	215,900-216,000	0.0208	700	1.49	10.4	No data	375
	221,350-221,700	0.0036	500	0.26	1.8	P (0.15 in.)	375
HV	157,750-158,050	0.0094	350	0.67	4.7	L	280
	162,500-162,700	0.0161	750	1.15	8.1	No corrosion	280
	166,000-166,800	0.0035	400	0.25	1.8	No data	280
	168,300-168,400	0.0121	500	0.86	6.1	No data	280
	193,600-193,800	0.0181	300	1.29	9.1	R	280
	201,100-201,300	0.0101	400	0.72	5.1	R	280
	204,700-204,800	0.0121	250	0.86	6.1	No data	280
	204,800-205,400	0.0020	300	0.14	1.0	L	280
	159,800-160,000	0.0040	400	0.28	2.0	L	280

V—very; B—bad; G—general corrosion; P—pitting; L—leak; Q—section reconditioned; R—section replaced.

Two Methods Described

As a result of three months' study of corrosion of pipe lines in Kansas, Oklahoma and Texas, Shepard has proposed two methods of determining corrosive spots along a pipe line right of way. The first is applicable only where a pipe line has already been laid, and consists in determining the places where electric current is discharged at comparatively high current densities. Shepard shows that these points of discharge indicate corroding areas, and that they are usually places where the resistivity of the soil is low.

The apparatus designed by Shepard for determining soil resistivity consists of two wooden rods. One of these rods is tipped with a steel cone about 2 inches long and one-half inch in maximum diameter; the other rod is tipped with a much smaller steel cone, and carries an ammeter and three-volt battery.

These rods are thrust into holes in the ground 6 or more inches apart, and the reading of the ammeter observed when the positive pole of the battery is connected through the ammeter to the small cone and the negative pole to the large cone. Since polarization is largely a cathode phenomenon, depending on current density, the use of a comparatively large cathode reduces polarization and gives results roughly comparable with alternating current measurements.

Unfortunately, it is very difficult to obtain complete and conclusive data in the field. Table 3 records some data taken from Mr. Shepard's curves. Column 3 gives the total discharge of current per square foot of anodic area. From this figure is computed the average total penetration of the electrolytic corrosion which is shown in Column 5. The values in this column should be multiplied by a pitting factor of from 10 to 20 to get the maximum rate of pitting. Comparison of Columns 5 and 7 makes it evident that even if a pitting factor of 20 is assumed, the current discharge is insufficient to account for more than a small portion of the observed corrosion. It is evident, therefore, that the discharge of current must be considered as an indication of corrosion rather than the cause.

At a number of locations along the lines tested the discharge of current and the soil resistivity are given where the condition of the pipe was not determined. The figures are helpful, nevertheless, in that they show the relation that exists between the two phenomena.

It will be noted that while in most instances there is a general correspondence between current discharge, soil resistivity, and condition of the line, the relations between these phenomena are far from simple.

California Test

A test which has been used rather extensively by three public utility companies in California is that described by Williams. A piece of three-fourths inch steel pipe is cleaned, weighed, and placed in the center of a quart tin can filled with the saturated soil to be tested. A two-volt battery is connected between the pipe which is made the anode and the can. After 24 hours the loss of weight of the pipe is determined and taken as a measure of the corrosivity of the soil. There is reason to believe that the loss of iron will be closely in accord with Faraday's law, i.e., will depend on the ampere hours involved and, hence, on the impressed voltage, the resistivity of the soil, and the amount of polarization.

While Corfield, who used this method and a six-volt battery, has shown that roughly comparable results can be obtained if the same apparatus is used for soils to be compared, it is evident that as in the Putnam experiment the shape of the apparatus affects the amount of polarization. The ratio of the polarization to the resistance of the soil also depends on the impressed voltage and the duration of the test. The temperature of the soil affects its electrical conductivity rather strongly, and under some conditions the soil temperature may be raised very considerably by the current passing through it. It is doubtful whether this test has any very positive advantage over a determination of the resistivity of the soil in question. Corfield reports that different types of soils give different types of pitting of the anodes, but he does not suggest any use for this observation.

Use of Soil Rod

Legg has developed a rather interesting piece of apparatus for the field determination of soil corrosivity. It consists of a metal tube in the lower end of which is inserted a tapered insulating rod, the point of which is tipped with a steel cone. A few inches from the tip is a copper ring. Insulated wires from both tip and ring are brought out through a hole near the top of the rod, which is capped with a head permitting the rod to be driven into the earth a short distance. A hole is made with a driving bar or soil auger to about the depth at which the pipe line is laid, and the test rod is inserted and driven until the copper ring makes a good contact with the soil. The current from the primary cell thus set up is measured by means of a milliammeter. The magnitude of this current depends on the tendency of the steel to go into solution, i.e., the potential of the steel with respect to the adjacent soil, the resistivity of the soil, the resistance of the milliammeter, the polarization set up at the copper ring, its potential with respect to the soil, and the dimensions of the apparatus.

The apparatus appears attractive on account of its simplicity and the absence of an external battery. It involves three factors known to be important in the corrosion of pipes: The steel-soil potential, polarization, and soil resistivity. Whether these are given proper emphasis and whether the incidental factors distort the indications of soil properties are not shown in Legg's report of his experiments. Since the potential set-up between the copper and iron electrodes will not obtain in practice, substitution of a steel ring with an oxidized surface might more nearly reproduce the potentials at the surface of pipe lines.

Shepard has made a comparative study of the Putnam, Williams and Legg resistivity methods of determining soil corrosivity, in which he made tests by each method on saturated soils from 22 Bureau of Standards' test sites. He assigned ratings for the corrosivity of these soils by obtaining the product of the rates of loss of weight and pitting as indicated by the 1930 field data for wrought specimens, and establishing an arbitrary scale in which the corrosivity of the most corrosive soil was assigned a value of 100.

On this rather arbitrary basis for determining corrosivity Shepard found the resistivity method to give a slightly better correlation than the others, although all of the methods gave approximately the same results. His charts showed the alkali soils, or those having pH values greater than seven, as falling within a relatively narrow band, indicating a fair correlation by all of the test methods; while for the acid soils, or those having pH values under seven, no useful or significant relation was observed.

Corrosivity Rating

In spite of the difficulty of obtaining satisfactory correlations between resistivity and corrosivity when soil types from all parts of the country are involved, there is ample reason to believe that a much closer relation exists between these phenomena in any one territory or soil type. Putnam and Corfield have worked only in California soils, and both report fair correlations. Shepard, in his work in Texas, Oklahoma and Kansas, found abrupt changes from high to low resistivity along any pipe line to be indicative of corrosion. While we cannot hope to establish a corrosivity rating over a wide range of soil resistivity, it appears that soils of unusually low resistivity are highly corrosive, and that abrupt changes in resistivity in one territory are significant.

The tendency of a soil to destroy a protective coating bears no essential relation to its power to cause corrosion. Little has been done toward identifying those soils destructive to coatings. Scott has shown that a large portion of coating failures are caused by soil stress. Part of this stress is caused by the tendency of some soils to form hard clods on drying. Another type of stress results from the change in volume of the soil with change in moisture. It is suggested, therefore, that when a soil survey is made, some attention be paid to the presence of gravel in the soil and the tendency of the soil to shrink and form clods. Methods for determining soil shrinkage have been described by the Bureau of Public Roads. In general, extensive shrinkage occurs only in soils high in colloids. If, therefore, the soil in question is loamy or sandy, it will not be mechanically destructive except in so far as distortion is caused by the settling of the soil in the trench. This can be provided against by proper back-filling.

Conclusion

An attempt has been made to state briefly the essential features of a number of tests for the corrosiveness of soils now in use in various parts of the country. The details of manipulation depend on the operator.

Most, if not all, of the methods for identifying corrosive soils have been shown by their originators to be reasonably satisfactory under some condition. None of the methods have been used extensively enough to permit defining their limitations. The best way to do this would be to try out each method along a number of pipe lines in various parts of the country, determining at the same time the condition of the line. Until the results of such tests are available, it would probably be advisable for the soil survey engineer to check his results by the use of two widely different methods, selecting the methods after determining

whether the soils are acid or alkaline. He might start with a method involving soil resistivity, indications of which will probably be significant if the resistivity is low. If the resistivity is high, the total acidity of the soil should also be investigated. Since soil conditions may change radically with the season, it will be well to give careful consideration to topography, drainage and rainfall. The services of an expert familiar with the identification of soils will reduce the number of necessary tests and the chances that some corrosive soils will be missed. If due care is used, it may be expected that a very large percentage of the corrosive and noncorrosive soils will be located.

LUBRICANTS MADE FROM CRACKED DISTILLATES

(Continued from Page 26)

yet have decidedly different temperature susceptibility.

It is interesting to note that the Dean and Davis viscosity indices varied from less than —300 in the case of oil from turpentine to 138 in the case of the oil from cetene, while the extreme range for mineral oils is from 0 for naphthenic oils to 100 for paraffinic oils.

The accompanying chart illustrates graphically the variation of viscosity with temperature of a number of synthetic oils in comparison with naturally occurring American oils. The ratio of the Saybolt viscosity at 100° F. to that at 210° F. is plotted against the viscosity at 210° F. Where more than one point is given for the same type of oil—e.g., synthetic oil from butene-2—it signifies that the oil was reduced to higher viscosity and viscosity determined repeatedly. The interesting fact is brought to light that the points thus determined for a synthetic oil fall on a straight line, whereas the lubricating fractions from natural oils give points which fall on a curve. The significance of this is not fully understood, but it may indicate that the synthetic oils are homogeneous in their chemical composition—i.e., contain the same type of hydrocarbons throughout the distillation range—whereas the natural oils may contain more paraffinic hydrocarbons in the heavy end than in the light end.

The two heaviest distillate oils prepared from ethylene by Nash and his coworkers are plotted for comparison. The viscosities were transposed to Saybolt and values are 100° and 210° F. obtained from a Herschel diagram. It is seen that these oils are distinctly inferior to natural American oils from the standpoint of viscosity-temperature characteristics, a fact which was recognized by Nash. The value for polymerized ethylene reported in Table 1 falls on an extension of the line through these points.

For further comparison, the viscosity of castor oil is also plotted, using data taken from the International Critical Tables. It is seen to be somewhat better than mixed-base oils with respect to viscosity-temperature coefficient, although quite inferior to the natural paraffinic oils and the better synthetic oils.

Experiments with the cracked distillates from various charging stocks were then carried out. From the data in Table 2 it appears that, in the case of gas-oil charging stocks, the more paraffinic the charging stock the better is the temperature coefficient of viscosity of the oil. In the case of wax-bearing stocks, the higher the wax content the better is the quality of the polymerized oil. Since it appeared from the preceding experiments that oils of the best quality resulted from the polymerization of normal olefines of fairly high molecular weight, and that materials closely approximating this nature could be produced by cracking wax-bearing stocks, it remained to determine what wax content was necessary and what the permissible range of boiling points of the cracked distillate might be.

Samples of paraffin wax containing varying amounts of oil were cracked in the vapor phase and the unsaturated distillates were polymerized under uniform conditions. As seen in Table 3, it was found that increasing amounts of oil in the wax used as charging stocks were accompanied by a regular increase in the temperature coefficient of viscosity of the resulting polymerized oil. The oil from refined wax possessed a lower temperature coefficient of viscosity, a higher gravity, and a lower pour test than any oil made from known crudes. Also the yields of viscous oil were better when charging stocks containing higher percentages of wax were used. The yields in Table 3 are comparable, but not the maximum attainable. These results indicate that in order to be suitable for use in the production of a synthetic oil having a viscosity index of 100 or higher, a wax should not contain more than 15 per cent oil. The yields depend on the nature of the distillate used and the conditions of polymerization. These factors will be considered separately.

Yield of Viscous Oil

Degree of Unsaturation—The distillate used in most of the experiments described was about 90 per cent unsaturated. The degree of unsaturation was determined by treatment of the distillate with 90 per cent sulphuric acid followed by a determination of the amount of polymers formed; the percentage by volume of unsaturated hydrocarbons in the original distillate could then be calculated as the sum of the treating loss plus the polymerization loss. The degree of unsaturation of the distillate had a considerable effect on the yield of viscous oil; for example, using a 60 per cent unsaturated distillate, a 20 per cent yield (by volume) of an oil having a viscosity of 200 seconds Saybolt at 210° F. was obtained, while polymerization of a 90 per cent unsaturated distillate under the same conditions gave a 35 per cent yield of 200-viscosity oil.

Boiling Range of Distillate.—The results of experiments on the effect of the boiling range of the cracked distillate on the polymerized oil (Table 4) confirmed the conclusions deduced from the experiments on pure olefins—namely, that the longer the straight chains in the unsaturated stock polymerized, the lower would be the temperature-viscosity coefficient of the resulting oil. The differences were insufficient, however, to justify the polymerization of anything other than the entire distillate. (With cracked Mid-Continent distillate the lower fractions yielded the oil of the lowest temperature-viscosity coefficient, which would seem to substantiate the assumption that the naphthenes were concentrated in the heavier fractions.) The higher the end-point of the distillate polymerized, the lower was the temperature coefficient of viscosity of the polymerized oil. The yield of oil was somewhat lower, however, when a distillate of higher endpoint was polymerized.

It was found that mixtures of unsaturated hydrocarbons gave a viscous oil whose quality could be predicted from the properties of the oils obtained when the various components were polymerized separately. For example, the oil obtained by polymerizing a mixture of propylene and cracked paraffin wax distillate suffered the same loss in viscosity when heated from 100° to 210° F. as a blend of oils made from propylene and from cracked paraffin, respectively. The relative amounts of the two oils in the blend were calculated on the basis of the yields obtainable from the two starting materials to give a blended oil containing the same proportions of propylene oil and cracked paraffin wax oil as the oil obtained by polymerizing the mixture. Moreover, polymerization of a solution of the calculated amount of propylene in a synthetic oil from cracked paraffin wax also gave an oil with the same temperature coefficient of viscosity as the blend just mentioned.

The boiling range of the distillate used may be varied according to the quality and yield of product desired, but a distillate having an endpoint of about 500° F. is ordinarily used. Polymerization of such a distillate gave a wax-free product and on reduction both the light overhead and the high viscosity bottom were of low cold test. A distillate cut at 550° or 600° F. contained some wax, and gave an oil from which the wax could be distilled on reduction, to give a low pour test bottom, but the overhead oil contained wax and had a high pour test. In the absence of any component, such as wax, which tends to crystallize on cooling, the pour test of an oil is a function of its temperature coefficient of viscosity; the lower the coefficient, the lower the solidification point.

Effect of Polymerizing

As previously mentioned, Brownlee carried out his polymerizations at temperatures between 300° and 400° F. (149° C. and 204.5° C.), using less than 0.1 pound of anhydrous aluminum chloride per gallon, and agitating for 1½ to 2 hours. Investigation revealed numerous improvements over those conditions.

Time and Temperature.—The yield of viscous oil was higher, the lower the temperature of polymerization, provided that all the olefins were polymerized. In this connection Lebedev and others reported that the lower the temperature of polymerization of unsaturated hydrocarbons, the greater was the increase in viscosity; Engler and Routala found that the proportion of naphthenes obtained in the polymerization of amylene with aluminum chloride was less at lower temperatures; Weizmann and Legg obtained considerable amounts of naphthenes by polymerization of butylene at relatively high temperatures. As expected, longer periods of agitation were required at the lower temperatures. The temperature finally adopted was 130-135° F., and the agitation with catalyst was continued for 30 hours at that temperature. The results are given in Tables 5 and 6.

Amount of Aluminum Chloride.—Although the use of lower temperatures ordinarily necessitated longer periods of agitation, the time could be shortened by the use of larger amounts of aluminum chloride. The effect of varying the proportion of catalyst is shown in Table 7. Although the use of more aluminum chloride shortened the time of polymerization, or increased the yield in a given time, the amount of sludge was thereby increased, which meant a decrease in ultimate yield of available viscous oil and an increase in cost of operation. It was found desirable to use about 3 per cent of aluminum chloride by weight.

After polymerization and separation of the sludge, the oil was washed with sodium hydroxide solution and then with water, reduced to the desired viscosity with fire and steam, and finally filtered through clay.

Other polymerizing agents were tested for the production of viscous oil. Among the catalysts used were silicon tetrachloride, titanium, tetrachloride, stannic chloride, phosphorus pentachloride, bismuth trichloride, ferric chloride, mixtures of ferric chloride and aluminum chloride, boron fluoride, and Attapulgus clay activated with hydrochloride acid. None of these substances was equal to aluminum chloride as a polymerizing agent under the conditions of temperature and pressure which were investigated. Boron fluoride accomplished considerable polymerization, but was distinctly inferior to aluminum chloride under the conditions used. Ferric chloride also accomplished some polymerization. Mixing with ferric chloride did not increase the activity of aluminum chloride, the effect of the mixture being about the average of the effects of the two constituents.

Properties of Synthetic Oils from Wax

Physical Properties.—Some of the physical properties of synthetic oils have been mentioned before. The following conventional inspection data summarize the properties of two principal synthetic oils which are commercially available.

	Oil A	Oil B
Grav., °A.P.I.	30.6	29.7
Flash, °F. (°C.)	515° (268)	615 (324)
Pour, °F. (°C.)	—20 (—28.9)	0 (—17.8)
Vis., Saybolt Unl.:		
100° F. (37.8° C.) seconds	350	3,250
210° F. (98.9° C.) seconds	35	197
Color, N.P.A.	2	2½
Conradson carbon, %	0.12	0.4
Slight oxidation, mg. sludge per 10 grams of oil	1.3	2.8

The high flashpoint, high A.P.I. gravity, low change of viscosity with temperature, and excellent color are outstanding.

Since no wax is produced in the polymerization, these synthetic oils are waxfree and consequently their pour tests are in direct proportion to their viscosity-temperature coefficients. As these are low, the pour tests are also low.

Chemical Properties—When heated to 100° F. with 93 per cent sulphuric acid, the synthetic oils darken and slowly evolve sulphur dioxide. At 200° F. the evolution of sulphur dioxide is quite rapid. Bromine is decolorized by the synthetic oils and large quantities of hydrogen bromide are formed, indicating the presence of reactive hydrogen.

When heated to 250° F. in an open dish in an oven the synthetic oil held its color much better than finished lubricating oils of the same viscosity.

In general, the oxidation stability of

TABLE 4—EFFECT OF BOILING RANGE OF CRACKED DISTILLATE FROM REFINED PARAFFIN WAX ON SYNTHETIC OIL

Distillate Fraction polymerized °F.	(°C.)	Vis. of Product 100° F. (37.8° C.) Sec.	210° F. (98.9° C.) Sec.	Viscosity index	Yield of oil Wt. %	Gravity °A.P.I.	Pour test °F.
Init.–200	(Init.–93.3)	1,083	83	87	52.0	31.5	—20
200–210	(93.3–154.5)	926	85	96	52.0	31.3	—20
310–420	(154.5–215.5)	637	84	124	69.0	34.4	—35
420–510	(215.5–265.5)	1,565	157	123	67.5	33.7	—10
Init.–428	(Init.–220)	797	85	109	45.0	33.1	—10

TABLE 5—EFFECT OF TIME OF POLYMERIZATION ON YIELD OF OIL
Stock, Cracked Distillate from 85% Wax; Temperature 210° F. (98.9° C.)

Time Hours	Viscosity of product 100° F. (37.8° C.) Sec.	210° F. (98.9° C.) Sec.	Yield of oil Wt. %	Gravity °A.P.I.	Pour test °F.
4	536	70	66.0	31.9	10
4	1,791	137	36.0	30.8	—20
9		83	66.0	32.0	0
9		137	42.4	...	0
9	2,069	154	39.0	31.0	—20
18	623	75	68.5	31.7	...
18	2,063	152	42.0	30.8	—20

TABLE 6—EFFECT OF TEMPERATURE OF POLYMERIZATION ON YIELD OF OIL
Stock, Cracked Distillate from 85% Wax

Temp. °F.	Time Hours	Viscosity of Oil 100° F. (37.8° C.) Sec.	210° F. (98.9° C.) Sec.	Yield of oil Wt. %	Gravity °A.P.I.	Pour test °F.
Room	114	1,273	110	51.5	30.5	5
Room	114	2,776	155	42.5	30.5	—15
150	18	1,172	106	56.0	31.0	—10
150	18	2,311	158	41.0	30.3	—20
210	18	623	75	68.5	31.7	5
210	18	2,063	152	42.0	30.8	—20
250	18	730	82	65.3	32.0	0
250	18	....	147	42.5	....	—5
300	18	425	63	64.5	33.4	10
300	18	1,732	138	35.0	30.4	—10

TABLE 7—EFFECT OF ALUMINUM CHLORIDE CONCENTRATION ON YIELD OF OIL
Stock, Cracked Distillate from 85% Wax

$AlCl_3$ based on charge %	Polymerizing conditions Time Hours	Temp. °F.	Viscosity of Oil 100° F. (37.8° C.) Sec.	210° F. (98.9° C.) Sec.	Yield of oil Wt. %	Gravity °A.P.I.	Pour test °F.
1.7	18	175–200	775	83	48.5	30.3	—10
3.4	18	175–200	730	82	65.3	32.0	—15
5.1	18	175–200	765	85	60.0	31.9	—10

the synthetic lubricating oils is equal, if not superior, to that of highly refined natural lubricants. Any oxidation which does occur in the case of these oils results in the formation of organic acid rather than sludge, and tests have shown the acid formation to be of same order of magnitude as with naturally occurring oils. The values for the Sligh oxidation test and Conradson carbon previously given in the inspection data are indicative of chemical stability.

Practical Tests—A synthetic oil of 157 viscosity at 210° F. was tested on a standard steering gear in comparison with a typical black oil gear lubricant of the same viscosity at 210° F. The synthetic oil required a torque of 0.5 pound at the circumference of a 17-inch wheel at 0° F., while the black oil required a torque of 5 pounds. At —20° F. the torques for the synthetic oil and black oil were 1.2 and 120 pounds, respectively.

In a typical transmission the shifting effort at —20° F. with a synthetic oil was 3 pounds. With a standard transmission lubricant of like viscosity at normal temperature, the shifting effort was 15 to 20 pounds.

After 50 hours service in the crankcase of a Knight motor, followed by filtration from suspended matter, the color of a synthetic oil of 85 viscosity at 210° F. had increased from 5.6 true color units to 101. Under the same conditions a Mid-Continent lubricating oil of the same viscosity increased in color from 163 to 762 on the true color scale. Owing to lower temperature coefficient of viscosity oil consumption was less with synthetic oil.

These oils have been given exhaustive tests in internal-combustion engines, and the results will be reported at a later date.

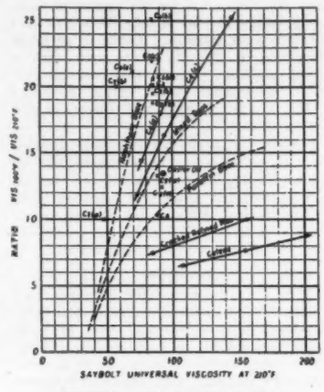
Discussion of Results

It has been shown that there is a close relation between chemical structure and the temperature coefficient of viscosity of lubricating oils. The polymers of the normal olefins from ethylene to cetene show that as the length of the straight chains increases the change of viscosity with temperature decreases. The polymers of the isomeric butylenes and amylenes show that, generally, the more highly branched the starting material the higher is the temperature coefficient of viscosity of the polymerized oil. In the polymerization of mono-olefins in the absence of dehydrogenation, the empirical formula would be C_nH_{2n}, in which case there can be no more than one ring per molecule. This would be of negligible effect in determining the physical properties of a hydrocarbon of 50 or more carbon atoms. In the case of the highest olefin investigated, cetene, the polymers contained waxlike solids.

These facts would lead one to expect that the normal paraffins would possess the lowest temperature coefficients. This is indeed so, as has been demonstrated by dilution of synthetic oil with low melting wax. A polymerized distillate was reduced to a viscosity of 82 at 210° F. and was found to have a viscosity of 797 at 100° F. The same oil was further reduced to 197 viscosity at 210° F. and mixed with 108° F. melting point paraffin wax. A mixture of 74.7 per cent of oil and 25.3 per cent of wax had a viscosity of 82 at 210° F. This mixture had a viscosity of 604 at 100 as compared with the previous value of 797. Although the viscosity of paraffin is so low that direct comparison with oils of high viscosity is difficult, a comparison has been made with a synthetic oil of low viscosity made from paraffin. This oil had a kinematic viscosity (centipoises) of 8.09 at 130° F. and 3.29 at 210° F., while the viscosity of wax was found to be 7.61 and 3.42 at the same temperatures.

Viscosity in liquids appears to be a function of two factors, the molecular weight and the intramolecular forces described as association or cohesion. Viscosity resulting from the latter effect might be expected to be more susceptible to change with changing temperature. This might be considered the reason why paraffinic oils, which possess the lowest viscosity for a given molecular weight and in which viscosity due to association or cohesion is at a minimum, possess low temperature coefficients of viscosity. Macleod has argued in favor of association as the cause of abnormal viscosity in alcohols and acids. His data indicate no regular relations between the viscosity and constitution of hydrocarbons. The known fact that naphthenic oils which possess high viscosity for a given molecular weight also have high temperature coefficients of viscosity should also be cited. Nash mentions oils made by the polymerization of ethylene which, although possessing the same molecular weight, are very different in viscosity and in temperature susceptibility. Similar data on natural oils have been published by Mabery.

The relation between constitution and viscosity indicated by this work seems to be more consistent than that which has previously been observed in the simpler hydrocarbons. Apparently oils of more



Viscosity Characteristics of Synthetic Oils

C₂(a)—Ethylene (Nash)
C₂(b)—Ethylene (Nash)
C₃—Propylene
C₄(a)—Butene 1
C₄(b)—Butene 2
C₄(c)—Isobutylene
C₅(a)—Pentene 1
C₅(b)—Pentene 2
C₅(c)—3 Methylbutene 1
C₅(d)—2 Methylbutene 1
C₅(e)—Trimethylethylene
C₆(a)—Hexene 1
C₆(b)—Cyclohexene
C₁₆—Cetene 1

Comparison of viscosity index of lubricants made of different base oils.

highly branched or cyclic structure have more "cohesive" viscosity and greater temperature susceptibility. Further investigation along this line may lead to a clearer understanding of the factors involved in the property of viscosity.

The pronounced superiority of the polymers of the higher normal olefins to any mineral oils led to a search for an abundant source of such material. It was found that cracked distillates from various gas oils could be polymerized to yield viscous oils whose properties were more or less paraffinic, according to the properties of the charging stock. In the case of wax-bearing charging stocks, the polymerized oils from the cracked distillates were paraffinic to a degree corresponding to the wax content of the charging stock and the polymers of the higher fractions were superior to those of lower boiling cuts.

These findings confirmed the deductions from the investigation of pure compounds. With a sufficient supply of raw material and the possibility of producing an outstandingly superior product, the manufacturing phases of the development were carried through. The refining of the crude polymerized product is very simple. An outstanding factor contributing to the simplicity of the refining process is the fact that, although made from wax, the product is waxfree and hence no dewaxing operation is involved. Natural paraffinic lubricating oil fractions contain wax whose satisfactory removal is accomplished with difficulty. In the present instance this constituent, often only an undesirable by-product, is converted to an oil more paraffinic than the distillate from which the wax was removed, yet entirely free from solid waxes.

While the major emphasis has been placed on the production of products superior to those occurring in nature, the field extending in the other direction has not been overlooked. The polymers of cyclohexene, and particularly turpentine, are more susceptible to change in viscosity with temperature than any natural oils. This is also true of the polymers of cracked distillates from naphthenic charging stocks. In general, the products obtained by the polymerization of cracked distillates from a given crude oil possess considerably poorer temperature coefficient than the viscous fractions of these same crudes. Furthermore, if polymerized oils are cracked and repolymerized, the repolymerized oils become successively worse.

Comparison of the properties of synthetic oils with those of natural lubricating oils results in certain justifiable deductions. Natural naphthenic oils of low A.P.I. gravity and poor temperature coefficient of viscosity resemble the polymers of cyclohexane and turpentine. It therefore follows that such oils are probably polynaphthenes with most of the carbon atoms in or attached to the rings. Natural paraffinic oils are of lower A.P.I. gravity for a given viscosity than the synthetic oils described. Consequently such oils are probably polynaphrhenes in which there are relatively few rings but in which long normal chains are prominent in the structure. These deductions are supported by consideration of the properties of the cracked distillates from such oils and the properties of the polymers of these distillates. It is improbable that any naturally occurring lubricants are highly branched acyclic compounds.

It has been stated that the unique properties of these synthetic oils render them especially adapted to the lubrication of mechanisms which are subject to changes in temperature, notably automobile transmissions, steering gears, and shock absorbers. When such service is encountered together with severe oxidation conditions as in aircraft engines, the combination of constancy of viscosity and resistance to sludge-forming oxidation exhibited by these synthetic oils makes them particularly well suited. The involved manufacturing process naturally entails a high cost; yet notwithstanding this, many special problems of lubrication are encountered where such oils provide a satisfactory solution.

CALIFORNIA GASOLINE STOCKS SHOW INCREASE

(Continued from Page 272)

California for the month. The detailed report follows:

CALIFORNIA NATURAL GASOLINE PRODUCTION, DISTRIBUTION AND STOCKS APRIL, 1931

Production by fields—	Gas treated*	Natural gasoline (gallons)
Fullerton and Whittier	778,399	1,785,257
Midway	1,852,437	3,283,697
Huntington Beach	602,024	1,887,542
Kettleman Hills	11,978,684	14,827,983
Long Beach	6,313,479	11,776,619
Richfield	463,001	599,262
Santa Fe Springs	7,243,254	10,836,423
Seal Beach	727,211	1,188,428
Ventura Avenue	5,289,344	4,765,198
All other fields	5,357,452	7,766,130
Total	40,605,285	58,717,139

*Thousands of cubic feet.

PRODUCTION BY METHODS

Type of plant:	Gas treated M.C.F.	Natural gasoline produced (gals.)	Gasoline recovery per M.C.F. gas treated
Oil absp.	40,447,324	58,518,350	1,447
Compressor	157,961	198,789	1,258
Total	40,605,285	58,717,139	1.446
			Bbls.
Finished gasoline produced at plants			166

Distribution—	Bbls.	Bbls.
Stocks first of month		1,543,805
Produced during month		1,398,027
Quantity mixed with crude or unfinished oils	88,342	
Used in blending at refineries	845,126	
Shipments	180,504	
Stocks end of month	1,695,831	
Balance*	132,029	
Total	2,941,832	2,941,832

*Includes evaporation losses, purchased by jobbers for blending, etc.

Stocks—	Gallons	Bbls.
Natural gasoline held by natural gasoline plant operators	4,252,481	101,250
Natural gasoline held by refineries	66,972,402	1,594,581
Total	71,224,883	1,695,831

PRODUCTION PROBLEMS AT A.P.I. MEETING

(Continued from Page 17)

tomorrow's meeting of the division. Governor Sterling's place on the program will be taken by Marion Church, Dallas attorney, who will speak on "The Texas Proration Laws."

Robert R. Penn of Dallas, chairman of the Division of Production, expressed the opinion that the petroleum industry, in its fight for proration and unitization, has made greater progress in the theory and practice of controlling production to meet demands than in any other industry. He held the same work must be done in all industries if prosperity is to return on a permanent basis and he called upon the petroleum industry to lead the way for such a return.

"Although different entirely in nature," he explained, "the oil industry is only one of those which are suffering from present overproduction and resulting depression. The condition is general and whatever else we may say about the causes of depression, it must be realized that the principal cause is periodic overproduction and overcompetition for market outlet, just as in the oil industry.

"We must learn, if we are to have permanent prosperity, to level down the peaks and fill in the valleys, to eliminate booms and depressions, to get business on an even course where it can carry on smoothly and with due consideration of the needs of our markets. We must learn to adjust production to consumption. We must learn to adjust employment so that every worker who is capable and willing may have his fair share of the work of the country; in other words, to abolish poverty. That may mean fewer days work per week or fewer hours per day, but the adjustments can be made if American business men will set themselves to the task."

Views on East Texas

Citing the immediate need of stabilization measures within the petroleum industry, Chairman Penn expressed the opinion that the new East Texas oil field will include at least 120,000 acres, that there is in sight from it at least 1,500,000,000 bbls. of oil, and that total production may exceed 3,000,000,000 bbls. Ten years would be necessary to exhaust the field, if production is at the rate of 400,000 bbls. per day, he estimated, declaring the industry faces no temporary situation in this area because it will be a flush field too long ahead to ignore its vast threat to the stability of the entire industry. He predicted the field may have 6,000 completed wells by early in 1932, if not more, with every well exerting pressure for a certain amount of production that it may pay out.

"In other words," he explained, "the more wells, the more pressure for production and the more oil produced; hence a lower price; as a result, pressure for still more production to keep up a certain number of dollars return per well; then again, a lower price, and so on through the course of the vicious circle until oil actually approaches zero from a standpoint of value.

"It is only necessary to look at the map to realize the enviable geographic position of the new East Texas Field, So strategic is that position that East Texas oil need only be sold cheaply in order to force its entrance into any of the principal markets of this country. East Texas can, as rapidly as conditions give the opportunity, take the markets of any of the other oil areas."

Mr. Penn held that it is necessary to achieve complete unitization of the East Texas Field and that all operators in the field must submit to the operation of unitization or to bankruptcy, adding that the field's output already has depressed oil prices to the extent of costing the industry a loss of $960,000 daily, or $350,000,000 for 1931 alone. But so great is the problem in the area, he said, that present unitization schemes would be unsatisfactory and he advocated formation of a great corporation to take over all the properties and issue stocks or certif-

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The Baker Cement Whirler Shoe, through the principles involved in its construction, offers an unusually high effectiveness in the cementing operation.

It contains the Baker-Formula Concrete Plug, in which is placed the Baker-designed NON-METALLIC Ball Check Valve. Leading out of this Valve chamber, a suitable number of side holes are placed well up from the guide. Superimposed over the outlets of these side holes are the baffle plates in the slots, and as will be noticed in the illustration, these baffle plates are placed at an angle upwardly from the horizontal diameter of the Shoe.

When the cement emerges from the slots it is given a whirling, spiral motion, which assures an even distribution all around the Shoe and casing, and effectively prevents any danger of channeling.

The Baker Cement Whirler Shoe is effective at all times. It is not dependent upon any sort of mechanical device in securing its spiral flow. It does not clog or plug the circulation—quite the reverse, in fact, owing to the ample capacity of the side holes. It may be set solidly on bottom without affecting, in any way, its operation. It may lean against the formation on one side, and still give full circulation on that side, as the slot is set INTO the Shoe, and not beyond its O.D.

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Corrosion Tests

Dr. Gordon N. Scott, United States Bureau of Standards, announces that all details have been arranged for examination of corrosion test samples and pipe line sections in the Spindletop Gully area in Spindletop Field, Texas, and this work will start June 5 and continue until completed.

Dr. K. H. Logan will also be at the test grounds. Sheds have been built and other arrangements made so that visitors can have the best of opportunity to secure detailed information about the results so far obtained.

Headquarters will be established by Doctors Scott and Logan at the Edson Hotel in Beaumont, Tex., during this period and while June 5 and 6 are the days set aside for this work it is anticipated that the period of examination will extend over into the following week.

AWAIT RESULTS OF CRUDE PRICE CUTS

(Continued from Page 18)

ing demand for naphtha no doubt would decrease.

East Texas Situation

As explained elsewhere in this issue, East Texas refineries are increasing rapidly in importance as a price factor in the Mid-Continent market. By the middle of the month six operating plants will be skimming from 30,000 to 35,000 bbls. of crude oil daily. These plants are in a position to manufacture all grades of gasoline, kerosene, distillates, gas oils and fuel oil. With the exception of the fuel oils, the bulk of which are sold to railroads or in the fields, the plant products are being offered on the open market.

Coming at a time when the spot demand for gasoline both for domestic and export shipment is exceedingly dull the 10,000 to 12,000 bbls. daily of gasoline which will be available by June 15, promises to be a more or less dominating factor in the Mid-Continent refinery tank car market. In shipments to the Texas Gulf Coast, the East Texas refiners now have a 15 cents per 100 pounds rate (.99 cents per gallon) as against 20.5 cents per 100 pounds (1.353 cents per gallon) for North Texas, and 22 cents per 100 pounds (1.452 cents per gallon) for Oklahoma and Kansas. This gives the East Texas refiners an important advantage in any export business on gasoline and kerosene that may develop during the summer months. In interstate shipments to the North, the East Texas refineries are on a parity with North and Central Texas and North Louisiana. This rate is 2½ cents per 100 pounds (.165 cents per gallon) over Oklahoma. In shipments to the Southeast, the East Texas plants are on a parity with the Shreveport, La., group of refineries with the exception of Louisiana, Arkansas and Mississippi. Efforts are being made to get rates based on mileage to these three States. Railroads serving the East Texas area are anxious to get business and are not wasting any time making attractive rates in the rail movement of both crude oil and refined products.

Most of the refineries in the field have their own pipe line systems and get their crude oil to their plants at substantially less cost than a majority of the refiners operating plants in competing areas. Some of the East Texas refiners have arrangements whereby they purchase their crude oil supplies from 10 to 25 cents a barrel under the prices posted by the major buyers.

Thus, the plant operators in that area have important advantages over most of their Mid-Continent competitors both from the operating and transportation angles and so far as the spot market is concerned are fast moving into a strong position. With the East Texas price schedules made effective a week ago met in other Mid-Continent fields on Monday, market observers are waiting the next move in East Texas posted and bootleg prices which will be reflected directly in the refined market situation.

Gasoline and Naphtha

U. S. Motor gasoline was sold by several refiners in Oklahoma the past week at 2⅝ and 2¾ cents. Some resale business at 2½ cents was reported. The latter price was readily obtainable from refiners in other areas quoting on a Group 3 basis.

At the same time, some of the larger refiners continue to quote up to 3 cents for their common domestic grade. Although usually referred to as a U. S. Motor grade, this 3-cent material usually is a premium product having up to 410 endpoint and low 10 and 50 per cent points. This gasoline also has better than the average antiknock rating, some of it being given an octane number as high as 70.

There was a brisk demand for blending naphthas, a 50-52 450 endpoint grade bringing a low of 2¾ cents and a high of 3 cents. There is a little trading now in a 56-58 450 endpoint gasoline. This grade which used to be the principal summer gasoline in the Middle West, is still in favor with jobbers. There is so little difference in refinery costs and with a strong naphtha market, most refiners prefer to keep their plant output confined to the U. S. Motor and other higher gravity grades.

Except for scattered domestic orders, there is practically no business in the higher gravity grades. Most refiners in their quotations maintain one-eighth to one-fourth cent differential but occasional sales of 400 to 375 endpoint materials at U. S. Motor prices are reported.

Kerosene

There is fair demand for kerosene and with settled conditions in the refined market generally it is probable that at least firm prices could be maintained. However, several refiners have reduced their quotations slightly and the 41-43 water white grade sold at a low of 2¼ cents in Oklahoma the first of the week. The 42-44 grade is one-eighth cent higher.

Fuels

Unless there is immediate improvement in the demand, fuel oil prices will go lower reflecting the new posted schedules for crude oil. One observer predicts that several of the larger and smaller operators will shortly pursue a policy of storing excess fuel oil even if they have to run it to earthen storage. The price is so low that the investment in this storage would be small and the chances for a profit with the return to normal conditions would justify this speculation.

It has reached the point where there is practically no demand for the higher cold test grades. These grades while not desirable for fuel, do not have a potential value as cracking stock greatly in excess of present quotations. Quotations on Oklahoma fuel oil start at 15 to 20 cents per barrel and end around 50 cents. Quotations on some grades are nominal.

U.G.I. and high cold test gas oils are quoted at three-quarters cent per gallon. There is a real scarcity of dark or straw color gas oils of zero cold test with a flash under 190. Buyers are in the market for this grade and apparently are willing to store at present prices. Sales which are only available from a few sources in Oklahoma were made as high as 1½ cents. Reflecting the condition of the market, sales of the regular grades of distillate were made as low as 1⅜ cents. Excellent grades of prime white distillates up to 40 gravity are available in the Mid-Continent at 1½ to 1¾ cents. Some of this material is coming from East Texas refineries.

Lubricants and Wax

Any price changes reported in neutral oils, bright stocks and steam refined stocks in Oklahoma are on the downward side. The 200, 3 color neutral which has held fairly well in recent months is now quoted at a low of 8⅜ cents and a high of 10 cents. The 4 color and 5 color grades are also lower.

Price shading continues in the bright stock market. One sale of high cold test 150-160 D under 13 cents was reported. With practically no demand for fuel oil and low crude oil prices, lower prices are in prospect for steam refined stocks. The larger manufacturers continue to quote a low of 3 cents. Wax quotations are unchanged.

Royal Dutch Report On Operations in 1930 Discusses Conditions

The 1930 report of the Royal Dutch Petroleum Co., signed by Sir Henri Deterding, its chairman, says the true cause of the present "unsatisfactory" prices for oil and other commodities is not overproduction but underconsumption.

The Royal Dutch Co. for the Working of Petroleum Wells in the Netherlands Indies reports for 1930 net income of 90,836,414 florins after expenses and taxes, equal, after dividends on 4 per cent and 4½ per cent preferred stock, to 17.87 per cent on 503,624,000 florins of ordinary stock. This compares with 126,471,391 florins net income of 24.85 per cent on 503,624,000 florins of ordinary shares in 1929.

The report gives the following figures on the company's oil production:

	Metric tons	
	1930	1929
Dutch East Indies	4,806,640	4,746,426
Sarawak	701,518	760,166
Egypt	281,997	271,520
Rumania	1,034,042	852,372
Mexico:		
Corona	284,749	363,361
Aguila	1,563,258	1,689,564
Venezuela:		
Caribbean	3,072,084	2,330,341
V.O.C.	5,878,186	6,469,206
Colon	705,261	.....
Trinidad	128,240	102,800
United States:		
Shell Petroleum Corp.	2,873,908	3,602,835
Shell Oil Co.	2,650,164	3,930,717
Argentina	9,980	15,079
Total	23,980,027	26,184,387

On these figures the report comments as follows:

"These figures demonstrate what has been achieved by our whole-hearted co-operation toward conservation, in respect to curtailment of production and increase of reserves. Otherwise, the production would have been much larger—at least 29,000,000 tons. The reduction was not solely a result of the shutting in and pinching of producing wells, but it was the beginning of a drastic curtailment of drilling."

The report is signed by Sir H. W. Deterding, general managing director, and J. E. F. De Kok and J. B. A. Kessler, managing directors. It asserts that improvement in the petroleum industry is dependent on co-operation, particularly in the restriction of production, and that, lacking co-operation, "the near future will be very dark for many, while the more distant future will have to bear the consequences of the damage about to be done."

The report accuses Russia of aiding in overproduction of oil, and also dwells on the reduced price of silver as a factor in world depression. It says in part:

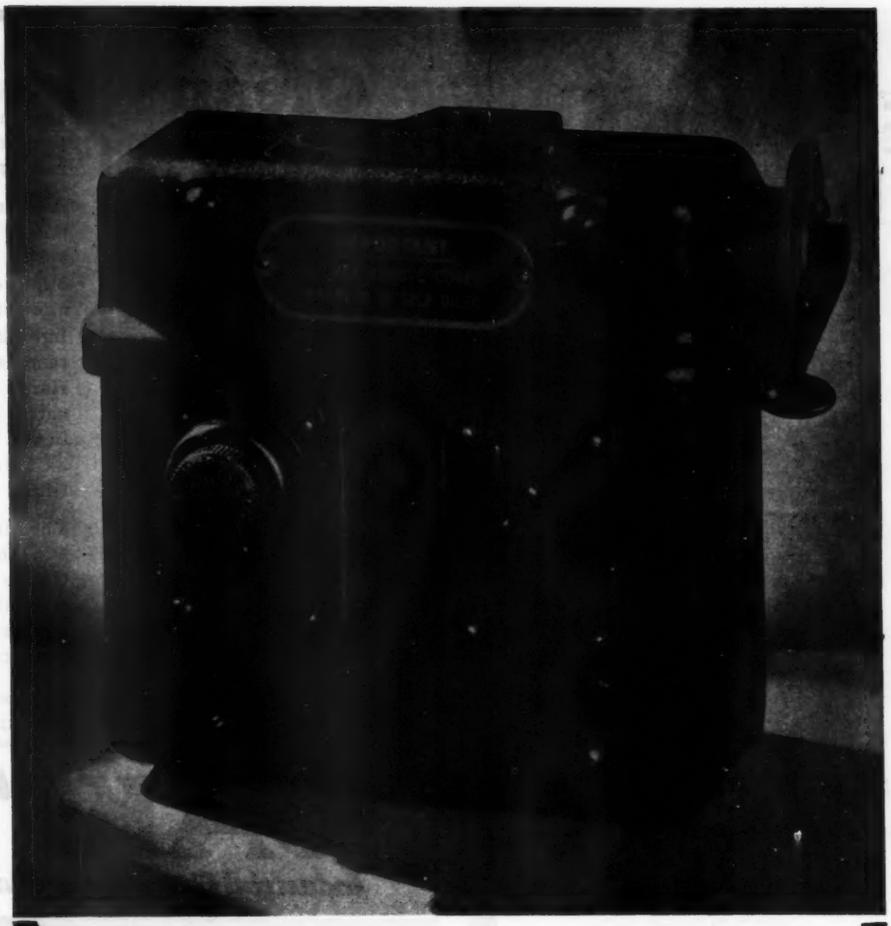
"It is true that prices have not improved during this period of conservation, but what would they have been if there had been no conservation? Of course, they would have been much lower. The fact that conservation has not resulted in bringing prices to a satisfactory level only proves that the overproduction and the accumulation of stocks have been so serious that even a year of conservation could not result in a reasonable price for crude oil and its products."

TO REVIEW CALIFORNIA LAW

The validity of California's statute directed to the conservation of oil and gas resources, involved in the case of Bendini Petroleum Co. and others versus Superior Court of California, etc., No. 852, will be reviewed by the Supreme Court of the United States, it was announced by Chief Justice Hughes.

IRAQ PETROLEUM AGREEMENT

Iraq Petroleum Co. has signed a new accord with the Iraq government whereby the latter foregoes all taxing powers but receives stipulated annuities. Work will be pushed on pipe line from Mosul to Kirkuk and there split, with one section going to Tripoli and the other to Haifa, on the Mediterranean.



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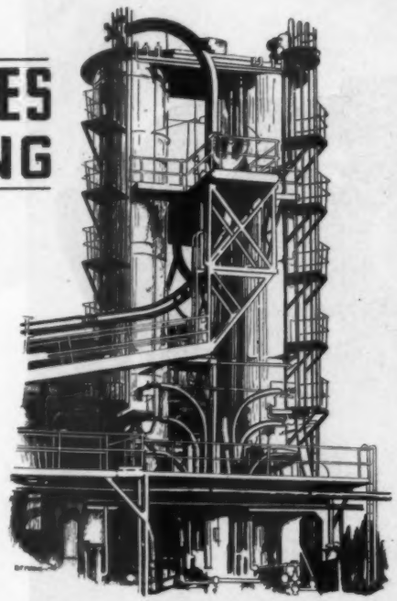

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INDUSTRIAL BROWNHOIST

CALIFORNIA OIL FIELD OPERATIONS FOR APRIL, 1931

According to figures collected by the American Petroleum Institute, Pacific Coast office, the total production of crude oil in California for April amounted to 15,803,541 bbls., an average of 526,785 bbls. per day. This is a decrease of 1,113 bbls. per day under March production.

Total stocks of crude and all products in Pacific Coast territory decreased during the month 459,157 bbls. The total stocks at the end of the month were 177,152,365 bbls. The total stock decrease for 1931, up to April 30, was 3,880,776 bbls.

Seventeen wells were completed during the month with an initial daily production of 16,653 bbls., compared with 18 wells completed during March with an initial production of 6,404 bbls.

CRUDE PETROLEUM PRODUCTION

(Figures of production and stocks are in barrels of 42 gallons)

	Barrels per month	Daily average April, 1931	Daily average March, 1931	Daily average April, 1930
Group No. 1—				
Coalinga	252,521	8,417	8,596	9,266
Elk Hills	446,137	14,871	14,628	20,193
Fruitvale	72,087	2,403	2,056	1,940
Kern River	339,367	11,312	10,678	15,630
Kettleman Hills	783,962	26,132	25,968	14,085
Lost Hills-Belridge	172,557	5,752	6,544	2,278
McKittrick	110,607	3,687	3,624	4,231
Midway-Sunset	1,618,479	53,949	52,656	66,878
Mount Poso	228,366	7,612	7,511	11,913
Round Mountain	6,300	210	220	3,938
Wheeler Ridge	15,799	527	536	599
Group No. 2—				
Capitan	.....	.....	34	19
Elwood	1,067,909	35,597	34,792	43,967
Rincon	58,800	1,960	2,214	2,824
Santa Barbara	9,960	332	178	.....
Santa Maria	81,000	2,700	2,572	3,115
Summerland	5,000	167	152	325
Ventura Avenue	1,344,816	44,827	44,719	45,285
Ventura-Newhall	110,275	3,676	3,594	4,982
Watsonville	1,908	64	62	63
Group No. 3—				
Coyote	310,215	10,341	10,452	10,369
Dominguez	355,019	11,834	11,899	9,718
Fullerton (Brea Olinda)	301,638	10,055	10,692	12,654
Huntington Beach	653,210	21,773	22,125	28,458
Inglewood	458,023	15,267	15,216	17,427
Lawndale	10,974	366	263	433
Long Beach	2,637,562	87,919	89,967	103,283
Los Angeles-Salt Lake	43,290	1,443	1,430	1,510
Montebello	214,333	7,144	7,160	7,317
Newport	1,117	37	37	40
Playa Del Rey	921,531	30,718	31,380	386
Potrero	18,542	618	721	1,336
Richfield	204,110	6,803	6,813	9,939
Rosecrans	114,641	3,822	4,000	6,395
Santa Fe Springs	2,149,409	71,647	71,112	128,073
Seal Beach	457,790	15,260	15,831	23,485
Torrance	189,929	6,331	6,046	11,871
Whittier	36,358	1,212	1,370	1,400
Total	15,803,541	526,785	527,898	625,625
March	16,364,842	527,898		
Decrease	561,301	1,113		

PACIFIC COAST TERRITORY PETROLEUM STOCKS

	April 30, 1931	March 31, 1931	April stock Decreases	April 30, 1930
Heavy crude, heavier than 20° A.P.I., including all grades fuel	105,844,270	105,708,874	*135,396	112,198,691
Refinable crude, 20° A.P.I. and lighter	42,928,028	43,017,172	89,144	44,475,703
Finished gasoline, engine distillate and natural gasoline	16,975,380	17,073,123	97,743	18,038,274
Naphtha distillates	3,191,183	3,303,101	111,918	3,184,353
All other stocks	8,213,504	8,509,252	295,748	9,295,738
Total all stocks	177,152,365	177,611,522	459,157	187,192,759

*Increase.

OIL FIELD DEVELOPMENT

	New rigs up	Active drlg.	Completed	Daily initial output	Active producing	Abnd. wells Drillers	Abnd. wells Producers
Group No. 1—							
Buttonwillow gas field	0	1	0	0	0	0	0
Coalinga	1	0	0	0	703	1	1
Elk Hills	0	0	0	0	213	0	0
Fruitvale	0	0	0	0	18	0	0
Kern River	0	0	0	0	905	0	0
Kettleman Hills	1	22	0	0	9	0	0
Lost Hills-Belridge	0	8	1	240	148	0	1
McKittrick	0	0	0	0	259	0	0
Midway-Sunset	0	3	0	0	1,833	0	1
Mount Poso	1	2	2	325	63	0	0
Round Mountain	1	2	0	0	1	1	0
Wheeler Ridge	0	0	0	0	34	0	0
Group No. 2—							
Capitan	0	2	0	0	0	0	0
Elwood	0	2	0	0	37	1	0
Rincon	1	4	0	0	32	0	0
Santa Barbara	0	0	0	0	3	0	0
Santa Maria	0	2	0	0	175	0	0
Summerland	0	0	0	0	97	0	0
Ventura Avenue	1	9	7	14,263	143	0	0
Ventura-Newhall	3	7	1	105	411	3	1
Watsonville	0	0	0	0	6	0	0
Group No. 3—							
Coyote	0	5	1	290	174	0	0
Dominguez	0	1	0	0	55	0	0
Fullerton	0	3	0	0	345	0	0
Huntington Beach	0	2	0	0	375	0	0
Inglewood	0	0	0	0	206	0	0
Lawndale	0	0	0	0	7	0	0
Long Beach	2	24	1	190	880	1	2
Los Angeles-Salt Lake	0	0	0	0	262	0	0
Montebello	0	0	0	0	165	0	0
Newport	0	1	0	0	4	0	0
Playa Del Rey	2	16	4	1,240	166	1	1
Potrero	0	2	0	0	13	0	0
Richfield	0	1	0	0	164	0	2
Rosecrans	0	1	0	0	92	0	0
Santa Fe Springs	1	1	0	0	460	0	1
Seal Beach	0	1	0	0	116	0	0
Torrance	0	0	0	0	382	0	2
Whittier	0	0	0	0	174	0	0
Miscellaneous drilling	13	147	0	0	0	10	0
April	27	269	17	16,653	9,130	18	12
March	24	276	18	6,404	9,125	33	36
Increase	3	*7	*1	10,249	5	*15	*24
Average for year 1930	80	434	63	48,710	9,632	21	27
Average for year 1929	109	610	76	100,625	10,550	26	18
Average for year 1928	107	520	59	56,802	10,833	15	25
Average for year 1927	97	404	75	39,992	11,276	23	21
Average for year 1926	95	422	76	32,635	11,288	24	17

*Decrease.

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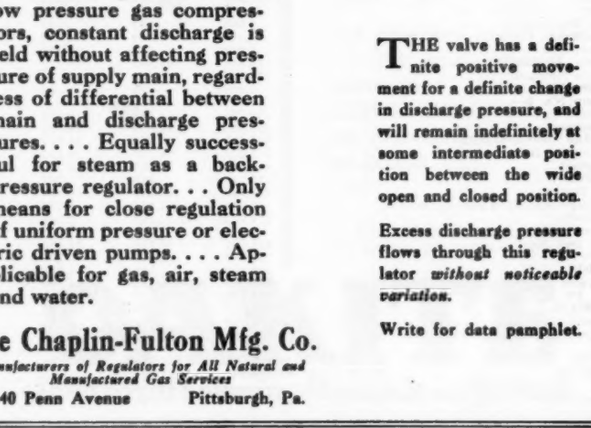

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DRAKE WELL MEMORIAL CONTRIBUTIONS WELCOMED

Contributons to the fund being raised to establish a park at the site of the Drake well near Titusville, Pa., have not been sufficient thus far to meet the expenses involved. Contributions of any amount may be sent to W. R. Boyd, Jr., chairman of the committee in charge of the project, who says the aid thus given will go far to lighten the load on the shoulders of the men who have assumed the responsibility of completing the undertaking. The accompanying subscription blank may be used.

DRAKE WELL MEMORIAL PARK FUND

....., 1931

I hereby subscribe $ ..... toward the fund for preservation of the Drake well site, to be paid on ....., 1931, and ....., 1931.

Cash herewith, $ .....

Signature.....

Address.....

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Fill out and mail to W. R. Boyd, Jr., American Petroleum Institute, 250 Park Ave., New York, N. Y. Make checks payable to "Drake Well Memorial Park Fund."

CENTRAL WEST FIELDS

(Continued from Page 56)

farm, SE, Section 4, Leopold Township, Perry County. Other Tell City business men are preparing to start several tests on nearby leases.

Reliable information as to size of wells and depths of sands is difficult to obtain in the southern Indiana area. It is understood that Mr. Conyers is contemplating building his own pipe line to Troy, where the Stoll Oil Refining Co. of Louisville already has a short line and loading rack. The unusual size of the new wells and their shallow depths make the new field attractive and doubtless a number of tests will be drilled. J. H. McClurkin, who first directed attention to the area, is understood to be arranging for several wells on some acreage he has recently acquired. He has confined his efforts during the past year to Tennessee gas fields and the newly discovered oil field in Hart County, Kentucky, where he mapped the field and drilled several wildcat wells in Hart and Green Counties.

H. J. Hauck and others' wildcat on the John Siddles, SW, Section 4, Lincoln Township, Laporte County, several miles south of New Carlisle, is ready to go, as the rig is up and awaiting the arrival of drive pipe and casing.

A. R. Manis and others are drilling on the S. Kauffman farm, Section 4, Washington Township, Greene County, which is east of Sullivan County and north of Daviess County, in the western part of Indiana.

Quite a few old wells were drilled many years ago in the old Trenton Rock area, known as the Montpelier Field. In Delaware County, Delaware Township, Max Zeigler & Brothers abandoned Nos. 2, 3, 4, 5, 6, 7, and 8 M. M. Friddle farm, and Nos. 1, 2, 3, 4, 5, 6 and 7 Lawrence Coons farm, all in Section 17. In Liberty Township, same county, Harley DeMoss pulled out Nos. 1 and 2 H. C. Ashcraft farm, Section 36, and Tharp & DeMoss did the same with No. 12 J. H. Baugh farm, same section.

In Randolph County, Monroe Township, Tharp & DeMoss abandoned Nos. 2 and 3 Rhoda B. Cockrill farm, and No. 1 F. E. Keever farm, Section 4. Charles Graf abandoned Nos. 1, 2 and 3 T. F. Adams farm, Section 9, and C. F. Chapman did the same with Nos. 1 and 4 Charles Jackson farm, also in Section 9.

ILLINOIS

Two completions were reported from Illinois since the last field review, both being dry holes and in Crawford County. They are the O. R. Oil & Gas Co.'s No. 2 O. H. Smith farm, Section 36, Prairie Township, and Phipps, Cawood and others' No. 1 I. Laughead farm, Section 3, Montgomery Township. In Robinson Township, same county, the Ohio Oil Co. abandoned Nos. 1 and 2 E. T. Wakefield farm, Section 13. L. C. McDowell and others are shut down at a depth of 998 feet in No. 11 on the J. F. Higgins No. 3 farm, Section 21, Montgomery Township.

KENTUCKY

W. F. McCray, manager of the Illinois Pipe Line Co., in western Kentucky, announced a few days ago that the production of oil his company is handling in the Owensboro Field had been increased from 33⅓ per cent of normal production to 50 per cent. The Producers Pipe Line Co. is taking nearly 40 per cent of the production it handles, Frank Wilson, Owensboro manager, stated. The Illinois Pipe Line Co. is now handling approximately 3,000 bbls. of oil per day while the Producers company is taking nearly 2,000 bbls. The Illinois Pipe Line Co. handled a total of 84,799.62 bbls. in April from the western Kentucky Field, and the Cumberland Pipe Line Co. handled a total of 166,133.49 bbls. from the eastern Kentucky fields. No reports are made of the crude handled by the Producers Pipe Line Co. through its line that handles crude in the Owensboro Field.

Hunting for Gas

According to reports received there are close to 200 gas wells in the Tri-County or Owensboro Field that have been shut in by the operators and indications are the owners of these wells are making preparations for the sale of gas. No great attention was paid to gas wells so long as the oil industry was flourishing in the producing areas of western Kentucky. Since the cutting of production to one-third, then one-half, the operators are interesting themselves in the gas business. The Kentucky Natural Gas Co., a subsidiary of the Missouri-Kansas Pipe Line Co., has its lines through western Kentucky. At the present time the Missouri-Kansas is laying a line from Terre Haute, Ind., to Evansville, to join with its lines from the western Kentucky fields. The Kentucky Natural Gas Co. is furnishing gas to Owensboro and a number of Kentucky and Indiana cities at the present time. The line to Terre Haute will be extended to Indianapolis and it is believed there will be a greater demand for gas.

Another large deal for gas lands has been made. The Wood Oil Co. has just transferred to the Kentucky Natural Gas Co., a subsidiary of the Missouri-Kansas Pipe Line Co., 26 tracts of valuable gas leases. This property is reported to be one of the most valuable lot of gas leases in the Owensboro Field and located largely in the northern Ohio County section.

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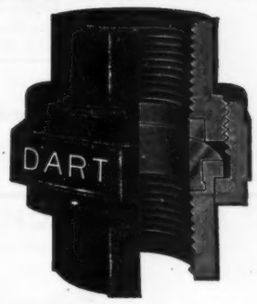

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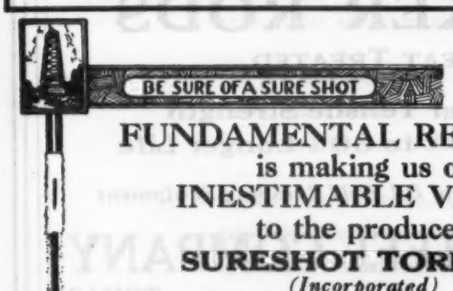

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The Louisville Gas & Electric Co. has a number of good gas wells in the Owensboro Field, of Hancock and Daviess Counties.

A well drilled on the Vincent Steel 125 acres, in the Buford Pool, in Ohio County, is said to show for 50 bbls. initial. It is owned by C. Mel Root. In the same pool another well showing for 60 bbls. initial was found on the Cicero Wade farm.

Hupp, Duff and others' No. 2 Claud Bolling farm, in the Pellville Field of Hancock County, was dry in the Jett sand.

Report from eastern Kentucky is that T. J. Asher has a gas well in No. 2 on the J. A. Hemminger farm, in the Red Bird section near the Clay County line, in Bell County.

Petroleum Exploration Co.'s No. 5 on the North Jellico Coal Co. land in the Barbourville Field of Knox County, is a gas producer. Same company has a gas well in on the W. S. Allen farm, in the Manchester Field of Clay County.

LESS POLISH REFINED OIL

During 1930 Polish refineries produced 580,310 metric tons of liquid and solid products, compared with 594,717 tons in 1929. The decline was mostly in liquid products, of which 3,742,411 bbls. were produced in 1930 and 3,875,638 in 1929. The 1930 liquid products consisted of 1,031,313 bbls. of gasoline, 1,340,246 bbls. of kerosene, 738,528 bbls. of fuel and gas oils, and 632,324 bbls. of lubricating oils. The last three products showed marked declines from the comparative figures for the preceding year but gasoline recovery was 19 per cent greater than the 867,314 bbls. produced in 1929, owing to the increased use of cracking equipment in the Polish refineries.

The solid products showed less decline from the 1929 record. In 1930 they included 33,824 tons of paraffin and candles and 18,185 tons of asphalt—both somewhat less than the 1929 production—but the 38,739 tons of greases and miscellaneous products represented a marked advance over the corresponding figure of the preceding year.

GEOLOGICAL SOCIETY TRIP

SHREVEPORT, La., May 30.—The annual field trip of the Shreveport Geological Society for 1931 will be held June 6 and 7. This year the society will visit Prothro Salt Dome in Bienville Parish and Winnfield Salt Dome in Winn Parish, Louisiana. Both these domes afford good examples of typical topographic salt dome development. The section from the Sparta down to the Blossom sand is exposed on Prothro Dome. Cap rock is exposed at the surface on Winnfield Dome, and diamond cores, showing the section from the surface into the salt on the latter dome, will be available for observation. If work on the shaft has progressed sufficiently, a trip into the salt mine at Winnfield is promised. W. C. Spooner, who is familiar with Louisiana salt dome problems, will conduct the party into the field. The Shreveport Geological Society extends a cordial invitation to all members of the profession to join them in this field trip.

YARMOUTH FRANCHISE

CHATHAM, Ontario, May 30.—Yarmouth Township, Ontario, has granted a tentative franchise to the Southern Ontario Gas Co. to sell natural gas, subject to a vote of the ratepayers. The Dominion Natural Gas Co. in 1925, secured a pipe line franchise through the township. The Southern Ontario Gas Co., a Dominion subsidiary, will supply gas at 85 cents per 1,000 for the first 10,000 feet, 60 cents per 1,000 over that amount, with 15 cents a month meter rent.

DEATH OF W. H. DERBY

LAREDO, Tex., May 30.—William H. Derby, 52 years old, associated with the Magnolia Petroleum Co. in the Laredo district for the past seven years, died in a hospital Sunday night after an operation. He was one of the best known oil men in Texas. Survivors are his widow, a son and two daughters.

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TEXAS OIL MAPS
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Catalog on Application
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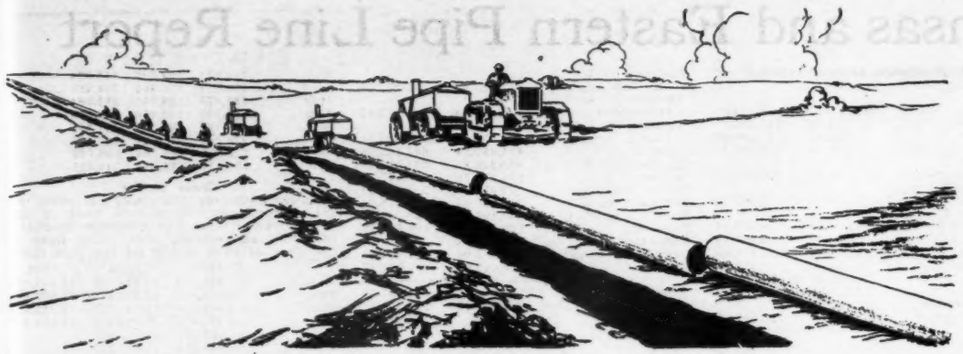
Read the Classified Bargains on Pages 266 267 and 269



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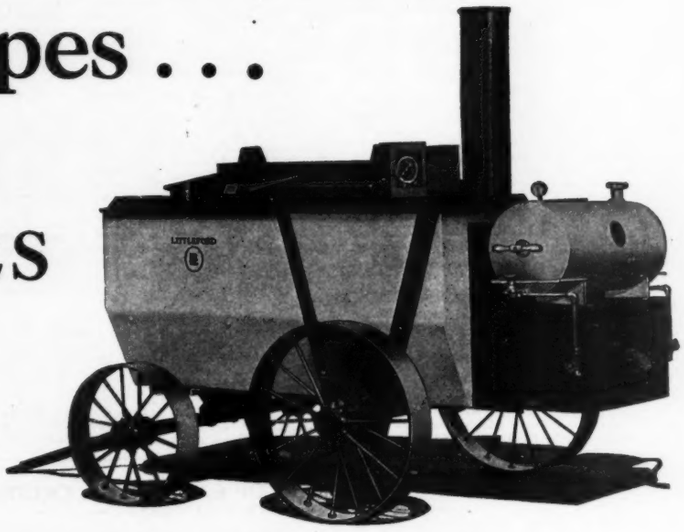

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Oklahoma-Kansas and Eastern Pipe Line Report

OKLAHOMA-KANSAS

Pipe Line Statement for March Runs

	Month (bbls.)	Dy.av. (bbls.)
Prairie Pipe Line Co.*....	995,100	32,100
Gulf Pipe Line Co.	1,231,758	39,754
The Texas Pipe Line Co. of Okla.	679,836	21,930
Magnolia Pipe Line Co...	1,518,727	48,991
Cosden Pipe Line Co.	744,653	24,021
Empire Pipe Line Co. ...	1,881,293	60,687
Stanolind Pipe Line Co.*.	3,224,000	104,000
Oklahoma Pipe Line Co..	2,459,757	79,347
Other lines*	7,068,800	228,000
Total, March	19,803,129	638,810
Total February ...	17,138,296	612,082
Difference	2,664,833	26,782

Shipments

Prairie Pipe Line Co.† ...	2,095,817
Gulf Pipe Line Co.	1,562,856
Texas Pipe Line Co. of Okla.	1,262,632
Magnolia Pipe Line Co. ..	1,286,452
Cosden Pipe Line Co. ..	699,793
Empire Pipe Line Co.	1,797,431
Stanolind Pipe Line Co.† .	3,534,651
Oklahoma Pipe Line Co..	2,424,293
Other lines*	7,099,000
Total March 21,762,925	
Total February 19,031,895	
Difference	2,741,035

Stocks

Prairie Oil & Gas Co.	37,274,000
Gulf P. L. & Gypsy Oil Co.	8,710,058
The Texas Company	3,821,029
Magnolia Petroleum Co.	6,323,742
Mid-Continent Petr. Corp.	3,737,883
Empire Pipe Line Co.	5,405,052
Stanolind Crude Oil Pur. Co.	18,306,000
Oklahoma Pipe Line Co.	3,563,570
Carter Oil Co.	3,888,504
Other lines	22,175,000
Total March 117,204,838	
Total February 115,434,237	
Difference	1,329,399

*Estimated. †Prairie and Stanolind shipments include Texas crude oil.

EASTERN PIPE LINE REPORT FOR APRIL

Runs from Wells

In the following table will be found the regular receipts from wells by various pipe lines in New York, Pennsylvania, West Virginia, Ohio, Kentucky, Illinois, Indiana and Michigan for March and April:

	Mar., '31	Apr., '31
Nat. Transit	137,918.13	142,938.57
S W Pa. P. L.	75,145.44	75,998.09
Eureka P. L.	294,873.95	294,234.07
Buckeye P. L. (Macksburg)	311,712.85	300,478.32
Buckeye P. L. (Cleveland)	11,769.49	11,192.35
Buckeye P. L. (Lima, etc.)	79,000.44	78,452.79
Indiana P. L.	3,199.09	2,976.41
Cumberland P. L...	168,106.26	166,133.49
N. Y. Transit	28,392.78	28,562.30
Tide Water P. L. .	24,005.40	27,008.85
Pure Oil	212,358.30	195,221.33
Stoll Oil Refining..	32,191.99	.....
Bradford Transit .	307,597.03	321,147.01
Total	1,684,271.08	1,647,436.50
Daily average ..	54,331.32	54,914.55

Petroleum Deliveries

The following tables exhibit the shipments or regular deliveries of various pipe lines in New York, Pennsylvania, West Virginia, Ohio, Kentucky and Indiana for March and April:

	Mar., '31	Apr., '31
Nat. Transit	565,889.04	480,757.15
S W Pa. P. L. ...	423,661.54	386,704.21
Eureka P. L.	328,329.66	260,404.46
Buckeye P. L. (Macksburg)	265,351.57	230,921.29
Buckeye P. L. (Cleveland)	2,440.89	2,198.31
Buckeye P. L. (Lima, etc.)	1,601,658.90	1,677,678.11
Indiana P. L.	737,337.17	998,276.65
Cumberland P. L. ..	110,949.07	108,989.29
Southern P. L. ...	79,090.42	30,351.93
N. Y. Transit	187,287.69	174,908.27
Northern P. L. ...	177,499.13	165,692.77
Tide Water P. L. .	362,962.53	451,375.06
Pure Oil Co.	246,505.63	228,993.49
Bradford Transit .	341,249.76	324,367.03
Tuscarora	443,677.56	283,195.69
East Gulf Oil	1,674.23	3,094.01
Total	5,874,764.79	5,743,508.77
Daily average ...	189,508.54	191,450.29

Gross Stocks

The gross stocks held by various pipe lines in the oil-producing section of New York, Pennsylvania, West Virginia, Ohio, Indiana and Kentucky and Indiana at the close of March and April:

	Mar., '31	Apr., '31
Nat. Transit	745,113.23	790,741.10
S. W. Pa. P. L. ...	369,482.29	538,731.14
Eureka P. L.	1,319,344.51	1,762,107.52
Buckeye P. L. (Macksburg)	565,767.95	513,877.24
Buckeye P. L. (Cleveland)	49,252.24	46,073.83
Buckeye P. L. (Lima, etc.)	3,619,389.13	3,730,603.33
Indiana P. L.	611,627.34	603,583.09
Cumberland P. L. ..	652,425.69	659,458.19
Southern P. L. ...	276,576.36	312,517.70
N. Y. Transit	145,013.40	109,007.83
Northern P. L. ...	342,338.93	291,059.44
Tide Water P. L. ..	1,030,157.40	900,197.73
Pure Oil	625,831.51	604,079.70
Tuscarora	12,347.56	12,173.30
Bradford Transit ..	143,165.90	164,714.43
East Gulf Oil	4,647.01	4,071.47
Total 11,012,162.56		11,044,487.59
Decrease	494,327.43	.....
Increase	.....	32,325.03

Grades of Oil

The following table shows the amount of the different grades of oil held by the Eastern pipe lines at the close of March and April, showing gross stocks of the above fields:

	Mar., '31	Apr., '31
Pennsylvania	3,847,625.68	3,866,991.57
Lima	791,559.81	809,732.51
Kentucky	667,373.51	674,030.47
Mid-Continent ...	5,090,403.22	4,984,054.76
Illinois	.....	16,978.58
Michigan	615,196.84	592,642.76
Total 11,012,162.56		11,044,487.59

Daily Average Runs

The following table shows the daily average runs of the Pennsylvania, Lima and Kentucky oil fields for the past four years:

	1928	1929	1930	1931
Jan.	52,904	51,749	75,907	53,939
Feb.	57,002	51,833	79,256	55,163
Mar.	57,485	54,252	76,688	54,231
Apr.	56,812	55,444	84,536	54,914
May	62,007	59,902	80,548	.....
June	58,230	55,533	75,430	.....
July	57,144	56,087	68,921	.....
Aug.	57,745	56,087	54,291	.....
Sept.	53,487	57,315	56,595	.....
Oct.	58,100	76,093	58,179	.....
Nov.	53,865	74,831	53,333	.....
Dec.	52,035	74,561	53,999	.....

Daily Average Shipments

The following table gives daily average shipments from the Pennsylvania, Lima and other fields for the past four years:

	1928	1929	1930	1931
Jan. 146,466		165,721	217,623	175,369
Feb. 167,368		159,587	224,355	183,494
Mar. 158,883		161,474	228,846	189,508
Apr. 172,935		169,737	241,845	191,450
May 180,559		184,231	248,383	.....
June 188,024		185,404	234,401	.....
July 189,470		194,763	207,094	.....
Aug. 192,853		194,946	205,506	.....
Sept. 194,128		201,214	192,999	.....
Oct. 176,060		191,367	157,475	.....
Nov. 176,896		202,742	144,628	.....
Dec. 173,572		186,267	143,001	.....

Gross Stocks

In the following table will be found the gross stocks of the various lines of the Pennsylvania, Lima and Kentucky oil fields, including oil received from other lines at the close of each month for the past three

	1929	1930	1931
Jan.	7,596,564	12,220,045	11,231,093
Feb.	8,738,335	12,991,561	11,506,489
Mar.	9,002,058	13,247,217	11,912,163
Apr.	8,978,172	13,233,961	11,044,487
May	8,905,560	13,052,953	.....
June	8,921,275	12,396,555	.....
July	9,211,595	12,268,542	.....
Aug.	9,440,643	13,047,051	4
Sept.	9,448,067	12,812,018	.....
Oct.	9,441,101	12,437,565	.....
Nov.	9,868,538	11,851,380	.....
Dec. 11,253,953		11,751,952	.....

The Illinois Field

The following table gives the report of the Illinois Pipe Line Co. in Illinois:

Gross stocks, May 1	644,216.76
Runs from wells	394,806.10
Other receipts	28,966.66
Regular deliveries	255,528.77
Other deliveries	165,979.13

The amount of Illinois oil run by the Tide Water Pipe Co. in April was 27,008.88 bbls. Deliveries were 27,008.88 bbls. Adding these figures to those of the Illinois Pipe Line Co. makes the runs and deliveries as follows:

	Runs	Deliveries
1931—		
April	421,814.98	282,537.65
1930—		
January	543,387.95	498,295.91
February	548,416.33	414,536.59
March	631,944.49	469,119.53
April	530,074.22	509,304.80
May	605,147.37	504,069.84
June	572,662.57	468,658.31
July	604,529.54	388,454.47
August	594,642.12	375,742.43
September	457,001.11	371,691.63
October	478,442.12	320,688.73
November	422,794.68	355,403.13
December	556,418.78	363,719.55
1931—		
January	468,429.04	469,573.19
February	429,254.64	461,262.56
March	424,834.35	356,643.34

Tide Water Pipe Co., Ltd., also delivered in April 685,176.61 bbls. Oklahoma oil.

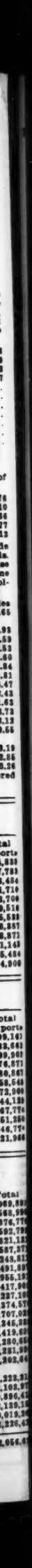
AVERAGE DAILY RECEIPTS OF CALIFORNIA CRUDE AND REFINED OIL AT ATLANTIC AND GULF PORTS

Average barrels per day in 1930-31—	ATLANTIC PORTS Baltimore	Boston	New York	Philadelphia	Others	Total	GULF COAST PORTS Galveston	New Orleans, Baton Rouge	Port Arthur, Sabine Pass	Tampa	Total	Total all ports
May	5,194	8,461	28,161	9,484	3,774	54,054	.....	.....	.....	.....	774	54,828
June	5,300	.....	33,933	20,767	3,333	63,333	.....	.....	.....	.....	2,400	67,733
July	17,355	7,774	43,419	28,839	6,452	98,839	.....	.....	.....	.....	4,645	103,484
August	7,418	5,742	38,968	21,326	5,258	81,613	.....	.....	.....	.....	97	81,710
September	6,300	6,400	35,600	13,400	9,567	61,367	.....	.....	.....	.....	3,433	63,700
October	3,516	3,065	27,355	16,419	4,903	54,161	.....	.....	.....	.....	5,355	59,516
November	5,367	6,233	13,800	17,733	4,600	76,733	.....	.....	.....	.....	4,800	75,533
December	5,516	4,333	30,645	9,676	3,580	53,743	.....	.....	.....	.....	4,645	58,387
January	5,387	6,613	31,965	14,678	11,096	62,742	.....	.....	.....	.....	8,129	68,871
February	5,787	2,713	29,143	4,000	5,750	47,393	.....	.....	.....	.....	3,750	51,143
March	10,032	1,611	21,333	7,324	3,774	43,129	.....	.....	.....	.....	6,355	55,484
April	5,133	.....	19,300	16,500	10,067	50,900	.....	.....	.....	.....	4,000	54,900

AVERAGE DAILY IMPORTS OF CRUDE AND REFINED OIL AT PRINCIPAL UNITED STATES PORTS

Average barrels per day in 1930-31—	ATLANTIC PORTS Baltimore	Boston	New York	Philadelphia	Others	Total	GULF COAST PORTS Galveston	New Orleans, Baton Rouge	Port Arthur, Sabine Pass	Tampa	Total	Total all ports
May	24,129	9,323	174,194	39,291	28,226	275,161	8,194	11,548	2,935	1,323	24,000	299,161
June	51,533	15,667	121,067	45,033	25,033	258,333	4,413	17,367	2,167	1,333	25,300	283,633
July	43,097	9,548	154,983	37,935	26,033	280,550	5,678	9,161	2,097	2,387	19,323	299,907
August	39,033	4,484	145,613	33,355	25,097	247,581	5,419	9,323	2,548	3,000	29,290	276,871
September	33,867	8,533	150,933	34,500	25,567	253,400	6,433	12,234	.....	3,800	32,467	280,867
October	19,339	11,742	146,194	35,355	26,967	240,097	6,065	7,067	2,774	3,548	18,451	258,548
November	39,633	35,900	124,633	36,467	24,667	261,300	2,467	7,366	.....	1,767	11,600	272,900
December	31,419	14,033	123,774	32,839	23,774	224,839	6,290	10,613	2,097	290	19,290	244,129
January	17,613	13,519	154,323	33,903	30,613	248,871	3,032	11,677	2,097	3,097	18,903	267,774
February	33,251	16,929	127,786	31,714	26,857	234,537	4,536	11,571	.....	536	16,643	251,180
March	27,645	18,935	141,160	36,290	31,129	255,161	4,065	2,580	.....	1,968	8,613	246,774
April	35,000	10,533	105,000	29,767	35,533	215,833	3,733	3,400	.....	.....	6,133	221,966

GROSS PRODUCTION OF CRUDE OIL IN THE UNITED STATES FOR 12 MONTHS

(In Barrels of 42 Gallons)

1930—		California	Oklahoma	Texas	Kansas	Arkansas	Louisiana	Rocky Mts	Eastern	Total
April:	Month	16,768,743	19,541,310	24,799,763	3,734,253	1,734,460	1,909,552	2,334,810	4,357,000	77,069,891
	Daily average	525,625	651,277	826,659	124,475	57,482	63,652	77,827	141,900	2,568,996
May:	Month	19,044,444	20,587,503	26,219,485	3,978,385	1,669,896	1,907,492	2,565,219	4,414,000	80,376,774
	Daily average	614,337	664,113	845,786	128,335	53,545	61,548	82,749	142,387	2,592,790
June:	Month	18,020,795	19,754,700	25,643,705	3,765,060	1,704,060	1,925,621	2,519,190	4,288,000	77,621,131
	Daily average	600,693	658,490	854,790	125,502	56,802	64,187	83,973	142,933	2,587,371
July:	Month	18,802,034	18,032,514	25,972,521	3,541,409	1,713,680	2,079,769	2,575,894	4,230,000	77,348,813
	Daily average	606,517	581,694	837,856	114,239	55,280	67,089	105,674	133,548	2,491,895
August:	Month	18,770,466	17,162,024	25,969,598	3,491,530	1,700,102	2,151,120	2,192,341	3,417,000	74,955,181
	Daily average	605,499	553,614	838,696	112,630	54,842	69,391	103,011	110,226	2,417,909
September:	Month	17,984,306	16,509,129	23,111,822	3,405,510	1,583,280	2,008,060	2,339,010	3,396,000	71,337,100
	Daily average	599,477	550,304	770,394	113,517	52,776	66,935	107,967	113,200	2,374,570
October:	Month	18,244,053	16,632,533	23,626,553	3,571,913	1,636,552	2,143,885	3,225,550	3,637,000	72,707,021
	Daily average	588,518	536,533	762,147	115,223	52,792	69,125	104,050	117,000	2,345,388
November:	Month	18,109,459	14,941,770	22,035,222	3,459,330	1,557,870	2,136,948	2,957,100	3,233,000	68,419,699
	Daily average	603,648	498,059	734,507	115,311	51,929	71,231	98,570	107,400	2,280,654
December:	Month	17,786,728	15,057,103	21,810,359	3,482,661	1,590,951	2,157,534	3,113,663	3,328,000	68,281,999
	Daily average	573,765	485,713	703,560	110,731	51,321	69,598	100,502	107,355	2,202,644
1931—										
January:	Month	16,435,798	14,350,953	20,690,452	3,143,072	1,574,955	2,131,937	2,946,142	3,374,000	65,223,319
	Daily average	531,793	479,063	667,435	101,583	50,805	68,772	95,682	108,839	2,102,978
February:	Month	14,930,932	13,371,876	18,964,596	3,369,016	1,402,492	1,981,476	2,747,034	3,129,000	59,896,424
	Daily average	533,248	477,567	677,307	120,322	50,089	70,767	98,108	111,750	2,139,158
March:	Month	16,364,842	16,430,341	22,975,309	3,498,598	1,444,941	2,053,197	2,897,725	3,374,000	69,019,953
	Daily average	527,898	530,011	741,139	112,858	46,611	66,587	93,475	108,839	2,226,434
	Total 12 months	215,512,590	202,871,747	280,920,388	42,296,728	19,293,235	24,565,941	35,039,668	42,654,000	862,954,6[illegible]